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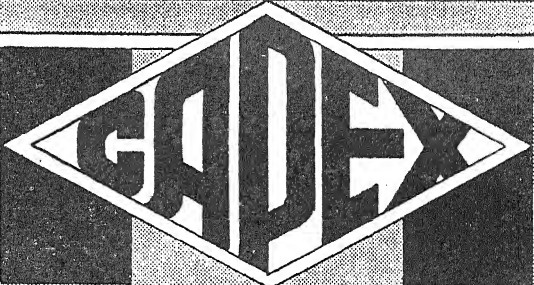
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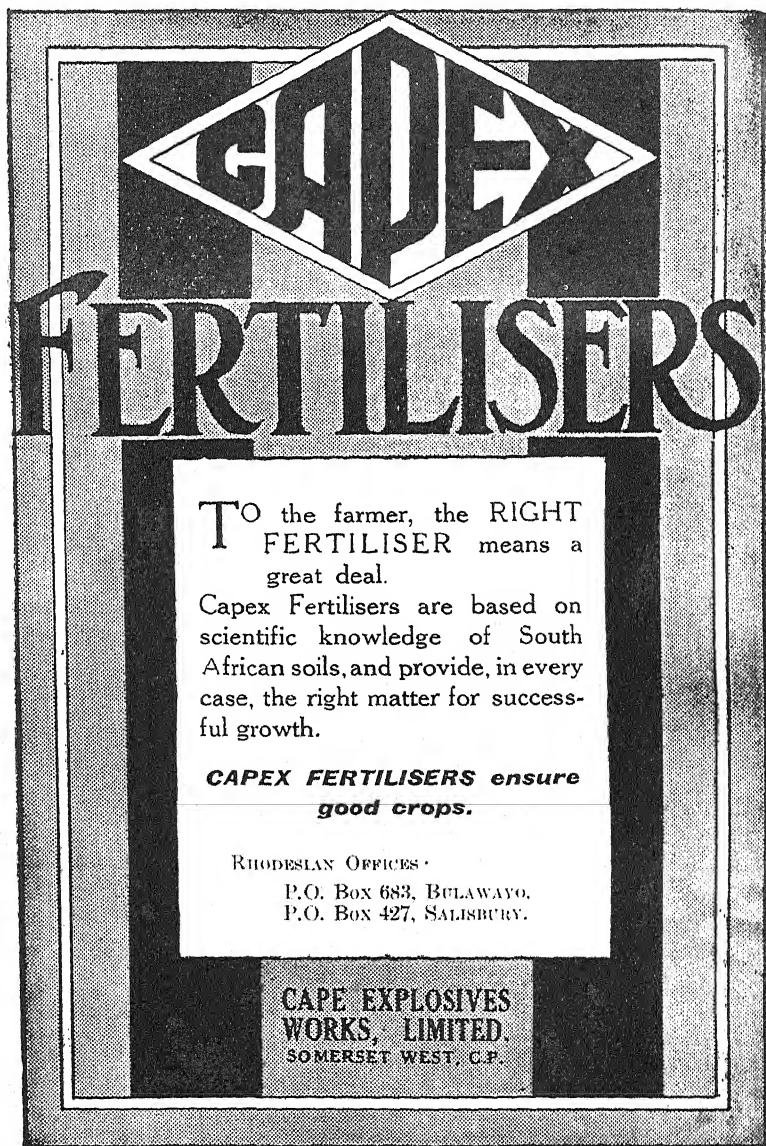
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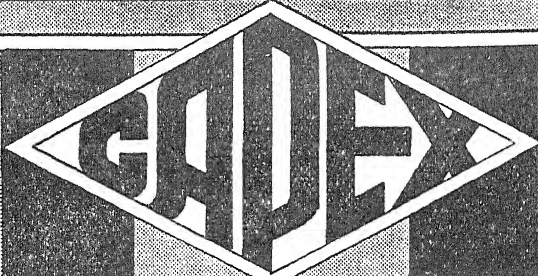
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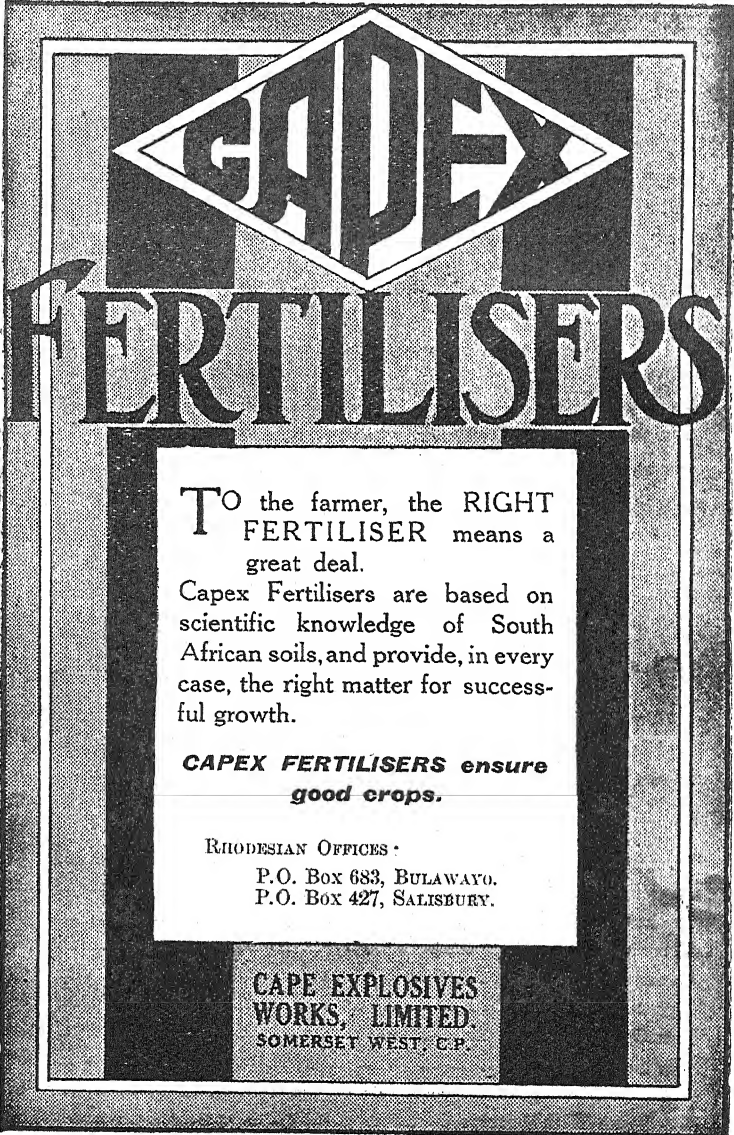
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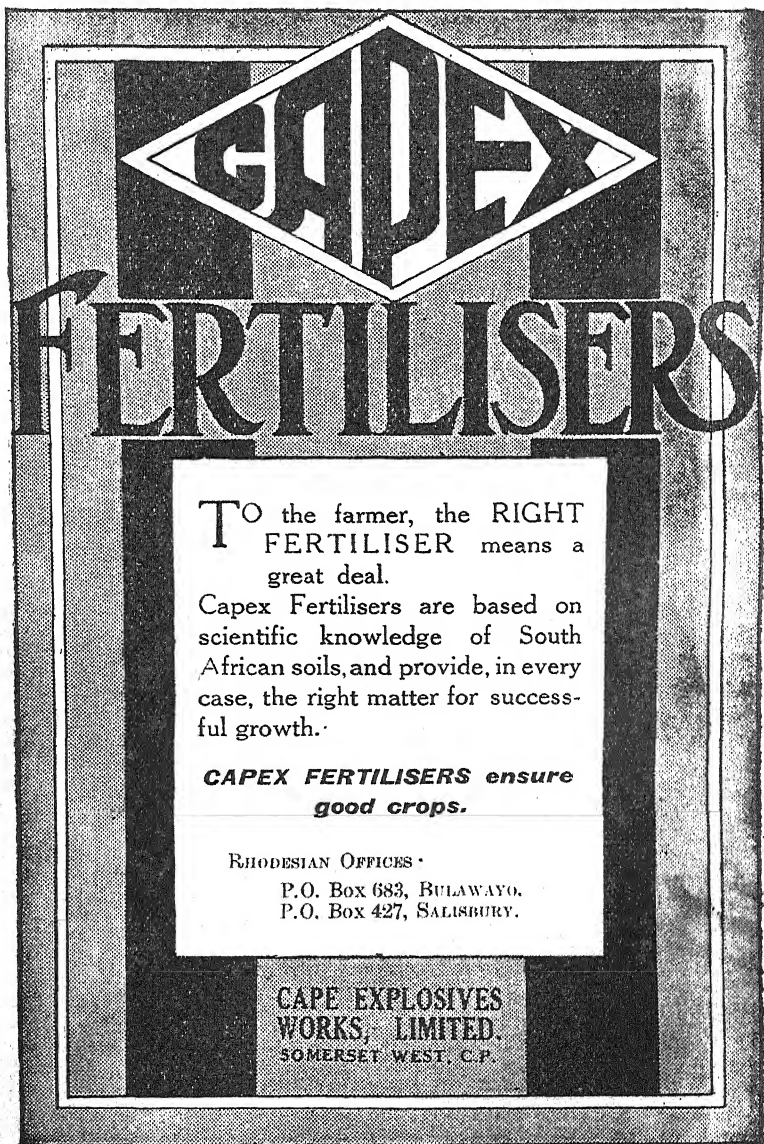
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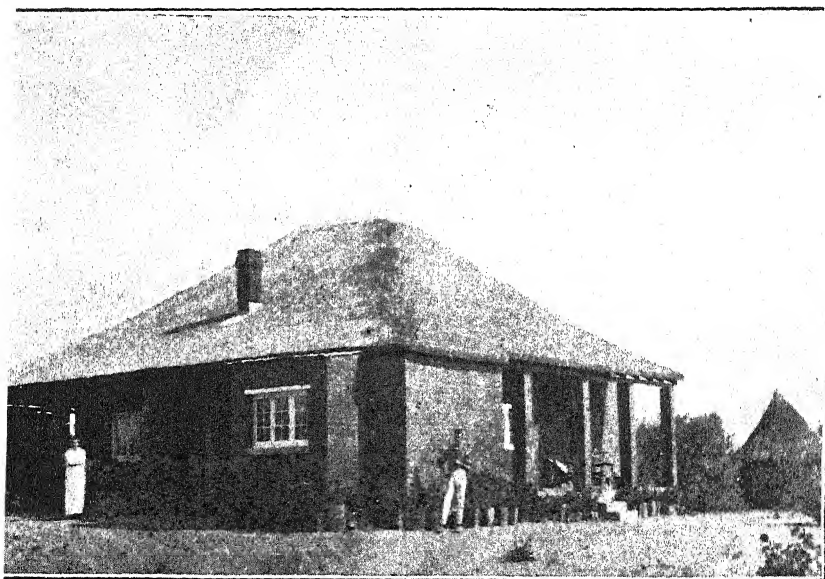
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Homestead of Mr. W A. Ludgater, Nyamambara, Bindura.



Homestead of Mrs. Radcliffe, Histonhurst, Fort Victoria district.



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VOL. XX.]

FEBRUARY, 1923.

[No. 1.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.

Tobacco.—Tobacco growers in Southern Rhodesia should welcome the news that the board of directors of the Rhodesia Tobacco Co-operative Society has arranged contracts for the sale of leaf to the Tobacco Development Company, Ltd., and Mr. M. Pevsner. The contracts cover a period of three years and include the following crops: 1922-23, 1923-24 and 1924-25.

Prices for each and every grade are fixed for the whole period, and are such that growers of good tobacco will be rewarded for their efforts. Growers are familiar with prices paid under previous contracts, and they will be pleased to learn that those laid down in the new contract are higher than prices previously paid. The buyers guarantee to

purchase up to 3,000,000 pounds from any one crop, and may take in excess of this amount if tobacco is available.

The contracts are the result of several months' negotiations, and it is confidently expected will form the basis of harmonious business between the society and the buyers. To the country at large the results of the negotiations will be both interesting and gratifying, as the new contracts assure, for the next three years at least, a profitable market for one of the principal agricultural products of the Territory. Beyond doubt the arrangements made for the sale of tobacco will lead to further development of the industry and to increased production.

During the final negotiations both the society and the buyers were fortunate in having the advice of Mr. F. Strause, Foreign Leaf Department, British American Tobacco Company. His sympathetic attitude and impartial advice helped materially in arriving at fair and workable contracts, and the tobacco growers of Southern Rhodesia will remember with pleasure his visit to this Territory.

Mr. Strause has had world-wide experience in the tobacco trade, and his comments on the industry in this country should be of great value to tobacco growers. In his opinion tobacco growing has prospects of attaining a very great magnitude in Southern Rhodesia. In the development of the industry growers must keep certain basic principles clearly in view. The present costs of growing tobacco are too high, and compare unfavourably with those in other tobacco-producing countries. In his opinion this is primarily due to individuals trying to grow too large acreages, with consequent low yields and loss of efficiency in the labour employed through lack of adequate supervision. He pointed out that, because an individual could grow a limited acreage profitably, it does not follow that if the acreage is doubled or trebled profits will increase in proportion; the reverse will most probably result. Mr. Strause pointed out that tobacco is a crop grown on small acreages the world over, and that, while the proceeds per individual were not great, the aggregate tremendously increased the wealth of the country. After visiting several districts, he was of opinion that the industry was capable of great expansion, but that this must be accomplished by increasing the number of growers, and not by increasing the acreages of those at present growing the crop. This points to the imperative need of a larger farming population.

Mr. Strause was firmly convinced that the society had adopted the correct attitude in regard to farm grading. In his opinion all tobacco should be graded on the farms, and the warehouse should be only a receiving, re-handling and sales dépôt. It is gratifying to note that this policy had been adopted by the directors of the society previous to his visit. In his opinion many grades of tobacco produced in Southern Rhodesia would find ready sale at remunerative prices on the world's market, but our inferior grades would not find a profitable market.

It is hoped that growers will in future only plant acreages in keeping with their complements of white and native labour and hand-

ling facilities, and thereby reduce the high percentage of inferior tobacco being produced at present. If this is done the average quality of Rhodesian tobacco will be greatly improved and the industry will prosper, to the advantage alike of the individual and the State.

Milk Records.—In these days of low cattle prices, it is instructive to learn what weight of milk^{and} and what monetary return is gained from each dairy cow. There are very few cows now being recorded in Rhodesia which give, in the aggregate, less than 300 gallons of milk during their lactation period. If this milk were made into cheese of the value of one shilling per pound, the gross return derived per annum from such a cow would be (besides the calf) in the neighbourhood of £15. If cream is sent to the creamery or butter made, the actual monetary return is less than this amount, but with pigs to consume the separated milk the aggregate return may be quite as high as £12 to £15. This is only a very conservative estimate, but nevertheless serves to show what returns can be obtained from the dairy cow as distinct from the beef animal.

The exact knowledge which milk records provide is exceptionally valuable, but there is another side which is hardly sufficiently appreciated. Testing and recording provides the cheapest, most efficient and quickest means of advertising. If any breeder spent hundreds of pounds each year in advertising in the Press, he could not get the same results as are now got by testing and by the publication of his records. If every farmer who is now sending in the records which are to be found elsewhere in this issue would endeavour to bring in his neighbour who is not testing, the scheme would become more widely spread and its benefits more widely realised.

Mexican Marigold.—Farmers' associations, municipalities, the railways, public bodies and the Press have from time to time been warned by the Department of Agriculture in regard to the nature of that objectionable weed known as Mexican marigold, and mounted dried specimens have been distributed to show all interested what it is like, together with pamphlets on the subject.

One outcome deserves special mention on account both of its efficacy and originality, and great credit is due to Miss M. A. New, of the Public School at Marandellas, for the idea and for carrying it out so successfully. The interest and enthusiasm of the children also deserve recognition. If the scheme were adopted by schools in all districts where Mexican marigold is found, it would undoubtedly have a beneficial effect, not only by direct diminution of the pest, but by bringing forcibly to the notice of parents and friends the presence of the weed and the possibility of successfully fighting it.

We quote from the report on the subject of the principal of Marandellas Public School, as follows:—

"It may interest you to know that when, as desired by the Agricultural Department, the children were last season reminded of the danger which threatens the country through the Mexican marigold, they responded at once to a suggestion that they should act as well as talk, and in their small way help to get rid of some in their own neighbourhood. The plants were large at the time, so were counted each day. At the end of that term they had collected 89,935 roots, which were made into a bonfire and destroyed.

"When the young seedlings showed themselves this term, at the children's own suggestion another competition was started. The roots were weighed each day at the close of school, as they were too small to count at first. The total weight collected by the end of the term was 10 cwt. 11.75 lbs."

Methods such as these are far more likely to prove efficacious in keeping this pest under control than legislative measures. The weed is an indigenous plant, and the prime necessity is that of recognising and controlling it in the early stages.

Bulawayo Agricultural Society.—The annual financial statement of the Bulawayo Agricultural Society, which has been published, shows a satisfactory position in that the society is perfectly solvent, and that the great annual show which it exists to conduct was last year as much a financial success as ever.

This is most gratifying in view of the fact that no prize money was given in any of the live stock sections, and the prize money in other sections was very considerably reduced. In this direction Bulawayo has given an important lead, and has demonstrated that so far as its exhibitors are concerned this heroic course has not discouraged them, and that they value the honour of a win at Bulawayo above the expense of exhibiting and the chance of gaining a money prize. The proposal has been discussed elsewhere, but we have not heard of any other society following this example. The saving in prize money enables improvements to be made in buildings, stands, rings and the show ground generally, but even so there is great need of generous support to the society's funds if the Bulawayo Show is to retain its high place and increase its beneficent work.

Investigations Overseas.—Mr. H. G. Mundy, Chief Agriculturist, proceeded on leave to England at the end of November, and during his vacation is enquiring into several questions of considerable moment to Rhodesia. Amongst the more important matters receiving his attention are the following:—

The conduct of feeding trials in England with white and yellow maize, with a view to showing, should it prove to be the case, that for

this purpose, and when used in conjunction with other suitable feeds, white maize is as valuable as yellow. At present there is a prejudice in favour of yellow for feeding, and, if this could be overcome, the British market for the white maize grown in Africa could, it is thought, be considerably improved.

Similar feeding experiments will, if possible, be arranged with velvet beans. This crop is so valuable in rotation and as a soil improver that, if a market could be found for the beans, it might be grown much more extensively, with direct benefit to the yields of other crops following it. To create this market, it is necessary first to prove the value of the crushed beans or meal to Home farmers.

A third matter receiving Mr. Mundy's attention is the possibility of converting hay or litter into valuable manure by means of bacterial inoculation, and without first using it as a bedding for farm stock. Investigations into this process are being carried out at the Rothamsted Experiment Station, Harpenden, England, and if these are sufficiently advanced and are applicable to Rhodesia, the weight of manure which could annually be made on most farms from otherwise unused veld grass would be very considerable.

A Farmers' Association Show.—The Umvuma Farmers' Association may be congratulated on the success attending its novel and enterprising effort to stimulate farming in the region which it serves. As a rule our associations limit their energies to discussing local matters, with occasional educative addresses or lectures. Shows, large or small, are generally run by separate societies or committees. The Farmers' Association of Umvuma, however, conceived the idea of holding a small show for the purpose of arousing friendly rivalry, demonstrating what the district could do, and incidentally of raising funds for its other activities. In spite of drought, quarantine, and bad times, a very happy gathering was held on Friday, 26th January, in a hall kindly lent for the purpose. The entries were awarded prize tickets, but, following the Bulawayo example, without cash awards, and after the show were put up for auction, netting to the association the substantial return of over £36. Everyone gave their services willingly, and joined together to make, socially and agriculturally, a success of the day.

Judging having been completed, the show was formally opened by the Director of Agriculture, who was able, after admitting a previous hesitancy, to felicitate the farming community of Umvuma on the display both of a wide variety of excellent produce and a most cheerful and courageous front in the face of adverse circumstances.

In the course of the afternoon an inspiring address on the prospects of forestry in Rhodesia was given by Mr. Henkel, the Forest Officer, who was able to paint his moral and adorn his tale by local references and facts within the knowledge of all. Over 80 persons attended the lecture, and warmly indicated their appreciation.

Amongst the exhibits was some excellent wheat in ten entries, also oats, barley, rye, emma, barley-wheat, buckwheat, beans, a display of fresh fruits which created much surprise, eight entries of butter and as many of eggs, cream cheese, lamb, bacon, sucking pig, dressed fowls, hay, besides jams, bread and cakes. Quite a number of the prize takers would have done credit to a large show. A striking display of Rhodesian teak woodwork, particularly doors and gates, by Messrs. Hepker & Co., of Bulawayo, attracted much attention, and there was also a display from the very recently established Government Forest Nursery at Mtao.

The little function was altogether admirable in its simplicity and effectiveness, and may well be brought to the notice of other associations for imitation.

The Government Plantations at Mtao.—The first trees in the plantations established by the Government at Mtao, in Chilimanzi district, were planted on Saturday, 27th January, a number of farmers and others resident in the district attending by invitation, for the purpose of assisting and actually themselves putting in the first trees of what is destined to become a great commercial and industrial enterprise, and the first of its kind in Rhodesia. The Mtao Forest Reserve has only lately been acquired by the Government, and steps have been taken for tree planting on a really large scale. The necessary preliminary measures take the form of provision of dwellings, nurseries and wells, and now the work of clearing and planting has begun. A most auspicious start was made, the weather proving ideal for the purpose. After a few appropriate remarks of welcome and explanation by Mr. Henkel, the Forest Officer, the first tree was planted by Dr. Nobbs, as indicative of the initiative taken by the Government in encouraging tree-planting by farmers, and then in turn each visitor planted a tree—farmers, miners and others, with their wives and children, including an infant of a few months old. All took part in the ceremony, and shared in starting what should ere long become a striking feature on the landscape, when for over five miles along the railway there will stretch a continuous block of timber trees, extending back and across the veld over 10,000 acres from the first line. The name of each planter has been recorded, and in all fifty-five marked trees will form the memorial of the day's work and of the initiation of an enterprise of which it would be difficult to exaggerate the importance or foresee the end.

Afforestation is not a matter for the State only, although the Government must give the lead. It offers a wide field for the investment of capital, the provision of profitable labour, and the utilisation of the land to great financial advantage, as well as producing a raw material which we know is a rapidly diminishing article throughout the world. The Mtao plantations and nurseries are in the charge of Mr. Willoughby, under whose efficient care they are likely to become an important influence in development of our midland districts.

Revised Rates for Maize and Maize Meal.—At a meeting of the Railway Rates Advisory Committee, held on the 21st instant, it was decided to apply the following revised charges, with effect from the 1st February next, viz.:—

Maize, in full truck loads or paying therefor, Scale D (page 131 of Goods Tariff Book No. 13).

Maize meal, in full truck loads or paying therefor. Scale D. plus 20 per cent.

Maize and maize meal, in less quantities than full truck loads, Scale E (page 132 of Goods Tariff Book No. 13).

The alterations involved under the above revision are as follows:—

- (a) The present minimum of 10 tons for maize carried at the rates under Scale D is amended to "full truck loads."
- (b) The rate for maize meal in full truck loads is reduced.

The general manager of the Beira and Mashonaland and Rhodesia Railways also estimates that the rate for maize consigned to Beira for export oversea during the coming season from the 300 to the 600 mile zone will be 15s. per ton, including pierage charges at Beira.

United States Maize Production.—In connection with the figures on the maize producers of Southern Rhodesia published in this issue, the following extract from the United States Department of Agriculture Year Book, 1921, will be interesting as affording a comparison: "Of approximately six and a half million farms in the United States, nearly five million produce maize. Nearly 100 million acres of farm land is devoted to the production of this single crop, which in recent years has reached more than 870 million bags. The 1920 crop had a value of approximately 450 million pounds sterling."

Export of Live Stock to Nyasaland.—Enquiries have been addressed by the Department of Agriculture here to the corresponding Department in Nyasaland as to the prospects and possibilities of finding a market for our breeding stock there. Now that direct railway communication exists in place of the previous cumbrous coastal and river steamers, it is possible to convey cattle, pigs and poultry comparatively easily, quickly and cheaply, and the Director of Agriculture at Zomba states that he believes a certain demand exists, and although it cannot, owing to the depression, be great for the present, it should increase as time goes on. The restrictions are not irksome, as is notoriously the case elsewhere, and are only intended to safeguard the interests of Nyasaland quite reasonably against introduction of disease. Conditions as to quarantine on arrival affect only the buyer, not the seller, and are also not unduly severe. Precautions for stock passing through fly belts in Portuguese East Africa similarly are for the consideration of

the buyer after purchase. It is well, however, that the seller should know what has to be done, for no doubt he can greatly assist the buyer in arranging details, and has of course to obtain the necessary certificates of health from the local veterinary authorities.

All live stock, including poultry, must be accompanied by a certificate from the chief of the Government veterinary service of the country of origin, stating that the animals are from farms that are and have been free from any contagious or infectious disease for at least two years prior to the date the certificate is granted. This would have to include a special statement with regard to tuberculosis for all live stock, and in the case of equines an additional statement regarding freedom from glanders. The animals would be subject to examination by a veterinary officer on arrival, and would have to undergo such tests and such period of quarantine as may be considered necessary by the veterinary officer after his examination.

With regard to cattle and equines, it must be borne in mind by persons importing that, unless arrangements are made to make the railway truck tsetse-fly-proof on the journey between Beira and the Zambesi River, the danger of animals becoming infected with trypanosomiasis would be very great. No doubt this could be arranged, if the matter were referred to the traffic manager of the Trans-Zambesia Railway at Beira.

All animals from Southern Rhodesia which have the certificate of a qualified veterinary surgeon in the service of the Government, covering the conditions mentioned above on which a certificate is required, would be admitted into Nyasaland without any undue restrictions. It is, however, necessary for persons who wish to import live stock to apply direct to the Chief Veterinary Officer, Nyasaland, giving full particulars of the numbers and species of animals they wish to import from Southern Rhodesia, so that His Excellency's authority may be obtained and the special conditions of importation made known to them. The destination in the Protectorate and the probable date of arrival should also be stated, as this information would facilitate the making of arrangements for their speedy release from any necessary quarantine restrictions.

It would perhaps be well for anyone desirous of establishing business connection for the sale of live stock of all kinds to Nyasaland from Rhodesia to pay a visit to Zomba, to become acquainted with conditions there, the route and the fly belts, places and facilities for feeding and watering stock on the way, and to secure representatives at that end advertising and coming in touch with buyers and so forth. In these days of restricted markets every opportunity to develop new outlets deserves attention.

Winter Cereals.—The attention of farmers is drawn to the notice in this Journal enumerating the varieties of winter cereals, such as wheat, oats, etc., available for free distribution from this Department

under the usual scheme of co-operative experiments. These crops include new varieties in most cases, suitable for growing as winter crops under irrigation or on wet vleis. The utility of these trials is obvious if the farming community is to keep pace with the improvements that are being constantly effected by plant breeders, which give better quality and increased yields. The extent to which farmers avail themselves of this service is indicated in the article on the subject which appears elsewhere in this issue.

Farm Homesteads.—We publish in this issue two further illustrations of farm homesteads, the first of which is of the pole and dagga type, the cheapest kind of dwelling house for a beginner, built by Mr. W. A. Ludgater, Nyamambara, Bindura. The roof is of combed thatch, so arranged that the leaking so common in the roughly thatched roof is entirely eliminated. A feature of this house is a sleeping room 15 feet square, with walls 3 feet 6 inches high, and 6 feet of mosquito gauze on three sides—ensuring a plentiful supply of fresh air, so necessary to a sleeping apartment in a tropical country.

The second is a contrast to the above, and is typical of a comfortable farm house usually found in Rhodesia.

Statistics of Crops grown by Europeans in Southern Rhodesia

FOR THE SEASON 1921-22.

By F. EYLES, F.S.S., F.L.S., Statistician, and H. C. K. FYNX.

Southern Rhodesia suffered severely from drought during the season 1921-22. The eastern, southern and central districts of Matabeleland, as also the major portion of Mashonaland, were chiefly affected. The mean rainfall of the Territory during the rainfall season, July, 1921, to June, 1922, was only 16.80 inches, as compared with a normal of 28.10 inches, a shortage of 40.2 per cent. The Lomagundi district and the northern portion of Salisbury district adjoining were favoured with a more generous rainfall than the remainder of the Territory. It is therefore apparent that the bulk of the crops harvested during the past season were produced on about half the normal rainfall.

Many of the farmers sent in crop returns showing a failure of most crops, while others were successful in reaping sufficient for their own use and for stock feed. Then there were those in the maize belt, and particularly in the Lomagundi district, who were fortunate enough to reap good crops of maize and of sundry side lines. The success achieved by the minority is all the more creditable, as showing that by scientific and thorough cultivation crops which may otherwise have been poor were successfully brought to maturity.

To ensure reliability of these statistics it is primarily necessary that all farmers should furnish returns. A few exceptions, through absence, illness or other accidents, are unavoidable, but experience goes to show that the same persons year after year only furnish replies when warned of the consequences, and a few are repeatedly in default. These old offenders cannot look for indefinite leniency, and they may be warned that steps to secure their compliance or punishment in the event of failure are very likely to follow repeated delinquency. No returns were received from eighty-four farmers, distributed chiefly as follows: Bulalima-Mangwe and Lomagundi 10 each, Charter 8, Salisbury 7, Makoni and Mazoe 6 each, Bulawayo, Insiza, Victoria and Marandellas 4 each, the remainder being made up of smaller numbers. Only eight districts out of 32 showed a clean sheet. One of the main excuses for default was that the farmer was compelled by circumstances to

seek a livelihood for a time in transport riding or in working on the mines to tide him over the worst period. Even "nil" returns are, however, required in order to ascertain the actual state of the country.

AREA UNDER CULTIVATION.

The total area under cultivation of summer crops only was 228,000 acres, which is only 9,268 short of the whole of the previous season's acreage, including winter crops.

The proportion of the total acreage devoted to cereals, exclusive of wheat, oats, barley and rye, was 84.1 per cent. The balance of 15.9 represents the area given to other classes of crops, such as legumes, succulents, fodders and sundry others.

The percentages of acreage under the principal crops to the total area under cultivation were as follows:—

Maize	79.7 per cent.
Maize (silage)	5.4 "
Tobacco	4.4 "
Ground nuts	2.3 "
Potatoes	1.2 "
Sunflower	1.1 "
Beans	1.1 "
Velvet bean hay	0.8 "
Teff grass	0.6 "
Kaffir corn	0.3 "
Sweet potatoes	0.3 "
Millet	0.3 "
Pumpkins	0.2 "
Cow pea hay	0.2 "
Napier fodder	0.2 "
Sundry crops	1.9 "
Total	100.0 "

MAIZE.

In January, 1922, the maize crop for the season was estimated preliminarily at 686,000 bags from 186,246 acres, but the final estimate, after the leading farmers and the Farmers' Co-operative Societies had been circularised, was fixed at 567,000 bags from 180,731 acres. The returns received now show that the later estimate was too low, and that the earlier forecast was nearer the truth. The total number of bags actually declared was 662,636 from 181,729 acres, or 3.6 bags per acre, the lowest acre yield since 1917.

The decreases in the principal maize districts were as follows:—

Lomagundi, 54,511 bags, or	39.1 per cent.
Hartley, 25,552 bags, or	41.3 "
Mazoe, 266,240 bags, or	41.9 "
Salisbury, 87,421 bags, or	46.2 "
Gwelo, 23,780 bags, or	62.4 "

From these figures it would appear that Lomagundi district suffered least in the whole Territory from drought.

The Mazoe district still holds premier position in relation to the highest district yield, viz., 367,686 bags. Salisbury district comes next with 101,778 bags. Lomagundi district takes third place with 84,901 bags. Hartley district is fourth with 36,281 bags. Gwelo comes fifth with 14,288 bags.

Production of Maize for the Five Years 1917-18 to 1921-22.

Season.	Acres.	Bags.	Yield per acre.
1917-18	192,148	591,722	3.08
1918-19	173,313	889,969	5.13
1919-20	173,467	1,120,548	6.45
1920-21	186,246	1,220,768	6.55
1921-22	181,729	662,636	3.64

The highest district acre-yields were:—Mazoe, 5.6; Melsetter, 4.3; Lomagundi, 4.2; Darwin, 3.7; Salisbury, 3.5; and Hartley, 2.8.

The highest individual acre-yields were recorded in the Melsetter district: 35, 22.5 and 13.3 bags respectively. These results were obtained, however, from small acreages, and cannot be regarded as an indication of the potentialities of the district as a whole.

The Position of Maize as a Crop.

Maize is rightly regarded as Rhodesia's main crop, because in quantity and value it exceeds any other, whilst it annually occupies more than three-quarters of all land under cultivation. The prominent position of the maize industry and the common knowledge of the facts here cited have given rise to the idea that most farmers in Rhodesia, outside the big ranchers, depend upon the production of maize for a means of living. This is far from being correct, and it will be an advantage to the country to make it known that the agricultural industry here is not based on a single crop.

An attempt to give statistical expression to the true state of affairs is shown in the following table, which has been compiled by dividing all maize growers into groups according to the amount of land they have planted to maize. It has been prepared from returns received of the crop for 1921-22, one of the worst on record; the figures given for gross crop, average farm production and average acre-yields would be doubled in a normal year.

The first group (A) consists of farmers growing 301 or more acres, the second (B) farmers growing from 201 to 300 acres, the third (C) growers of 101 to 200 acres, whilst group D includes all men growing 100 acres or less, and E comprises those who do not plant maize.

MAIZE CROP—1921-22.

Analysed in groups according to the number of acres of land planted to maize on each farm.

Calculated on $\frac{1,344 \text{ maize growers}}{2,034 \text{ farm returns}} = \frac{66.08 \text{ growers}}{100.00 \text{ farmers.}}$

Farmers, grouped according to size of maize lands, in acres.		Maize Growers.			Area under Maize.			Crop.			
		Number.	Per cent. of all farmers.	Per cent. of all growers.	Acres.	Per cent. of area.	Average acres per farm.	Number of bags.	Per cent. of total crop.	Yield per acre, bags.	Average harvest, per farm.
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
A ...	301 and over ...	139	6.8	10.34	74,282	43.8	534	368,068	59.3	4.95	2,648
	201 to 300 ...	113	5.6	8.40	30,261	17.9	268	114,825	18.5	3.79	1,016
C ...	(A + B) ...	252	12.4	18.74	104,543	61.7	415	482,893	77.8	4.62	1,916
	101 to 200 ...	178	8.7	13.24	27,877	16.5	156	69,754	11.2	2.50	392
D ...	(A + B + C) ...	430	21.1	31.98	132,420	78.2	308	552,647	89.0	4.17	1,285
	100 and under ...	914	45.0	68.02	37,004	21.8	40	68,044	11.0	1.84	74
E ...	(A + B + C + D) ...	1,344	66.1	100.00	169,424	100.0	126	620,691	100.0	3.66	462
	None ...	690	33.9								
	(A + B + C + D + E)	2,034	100.0								

First note that group E, 690 farmers, or 34 per cent. of the total, do not plant any maize at all. Next observe that group D, 914, or 45 per cent. of farmers, grow 100 acres or less of maize, and so obviously do not depend on this crop for a living, especially when it is seen that their average harvest last season was under 2 bags per acre. Thus we have 1,604 (690 and 914) farmers, or 79 per cent. of total, who cannot be ranked as essentially making a living as maize farmers. Those men in group C who grow 200 acres or less of maize occupy a doubtful position. The average production of their lands last season was $2\frac{1}{2}$ bags per acre—a harvest of 500 bags at the top of the group—and although in a good season the top men of the group would reap about 1,000 bags, it cannot be supposed they depend on this crop alone for a living. There are 178 men in this group—3.7 of total farmers. They may be regarded as mixed farmers, who do not contribute an important proportion of the country's total production of maize. Now add together the three groups so far discussed and we get the following result:—

Group.	Number.	per cent. Farmers.	per cent. Crop.
E	690	33.9	—
D	914	45.0	11.0
C	178	8.7	11.2
	1,782	87.6	22.2

That is to say over 87 per cent. of the farmers are not large growers of maize, and few of them can rely solely on that crop for an income.

The remaining two groups (B and A) therefore produced 77.8 per cent. of the country's crop of maize, and they alone contribute seriously to the bulk of grain for export in ordinary seasons. There are only 252 men within the two groups, and last season these few farmers produced not less than 482,893 bags out of a total of 620,691 bags of maize. The average size of their mealie lands was 415 acres, from which they reaped on the average 1,916 bags, or an acre-yield of 4.62 bags, which, considering the adverse conditions, was remarkably good.

Considering groups B and A separately, we find that group B, 201 to 300 acres, consists of 113 farmers, who produced 114,825 bags of grain, the average size of their maize lands was 268 acres, and their average harvest 1,016 bags, or 3.79 bags per acre.

Group A is, however, from the point of view of grain production, by far the most important. Here are 139 farmers, or only 6.8 of total, but between them they produced 368,068 bags, or 59.3 per cent. of the total crop of the country. Their maize lands averaged 534 acres each, and gave an average harvest of 2,648 bags to each farm, equal to an acre-yield of 4.95 bags. It may be expected that in an ordinary season this small group will produce 10 bags or more per acre, or not less than 750,000 bags of maize from 140 farms.

Proceeding from details to general considerations, we find from the table that the yield per acre of maize increases from group to

group in a ratio directly proportionate to the amount of land planted, i.e., the greater the acreage the greater the acre-yield of grain. A casual or thoughtless observer might deduce from this an argument in favour of extensive farming, saying, the more land ploughed the larger will be the harvest per acre. Such argument confuses cause and effect. The farmer does not get high acre-yield because he plants large fields, but he plants large fields because his land gives a high acre-yield. Therefore we conclude that groups A and B are men owning rich lands capable of producing 8 to 15 bags per acre as a rule, and it pays them to grow on a large scale. From the smallness of the number of men who are commercially successful mealie growers, it may be inferred that the so-called maize belt is not large, although it is being steadily added to yearly.

We thus arrive at the conclusion that, though maize is Rhodesia's main crop, it is not the mainstay of the majority of Rhodesian farmers. Apparently over 80 per cent. rely upon other things for a livelihood, and it becomes obvious that the idea that Rhodesian farming consists wholly or chiefly in growing maize is contrary to fact.

Group E of the table probably consists largely of ranchers, tobacco planters and citrus growers, who are independent of maize, or find it cheaper to buy than to grow their requirements of grain.

Groups D and C may be regarded as mainly composed of true mixed farmers, who are in many ways the most valuable and stable part of a farming community. They form over 53 per cent. of the total, and their farming, while including sufficient maize for home use, and often a balance for sale, consists of a variety of other crops such as wheat, ground nuts, potatoes, tobacco, fodders, in most cases also supplemented by dairying, pig rearing, etc. Under this system of farming, the owner is in the happy position of having more than one crop to rely on when a bad season comes along, so that though half his crops may fail, the other half may yield sufficient to tide him over the period of difficulty.

Only 12 per cent. of Rhodesian farmers are large scale growers of maize, and while doubtless some have yielded to the temptation of easy money by single cropping, it is well known that many are fully alive to the need of rotation, and are in the fortunate position of being able to utilise the wealth derived from their grain crops to conduct true mixed farming on scientific and generous lines.

The relatively high acre-yields of maize obtained by the farmers of groups A and B in a season of severe drought is an eloquent testimony to the fertility of their lands and their skill in handling the crop.

It is right to point out that the scheme of grouping here adopted is an artificial one, and necessarily obscures the fact that there are men in each group who differ widely from the general character of their group; for instance, there are farmers falling into group D—because their acreage is small—who have produced 10 or 12 bags per acre, while there are others in the top group whose acre-yield was as low as 2 bags. All systems of grouping must be artificial, not excepting the common method of grouping by districts, for the con-

ditions of every district vary greatly, and results and averages based on a district must be considered as qualified by that fact.

The table was compiled before the last delayed returns were received, but the few figures since to hand are not sufficiently important to modify the averages or to necessitate a re-casting of the table.

Maize Exports.

The latest available statistics under this head are those contained in the Trade Statement issued by the Customs authorities of the Union for October, 1922. For the purposes of this report it will suffice if the exports for the ten months ending 31st October, 1922, are given:—

Maize, 4,425,874 lbs. (22,129 bags), valued at	£9,018
Maize meal, 9,331,191 lbs. (51,839 bags), valued at	20,369

As against maize, 250,242 bags, valued at	121,098
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And maize meal, 94,064 bags, valued at	69,823
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for the same period in 1921.

Maize Imports.

During the same period as the above, maize and maize meal were imported as follows:—

Maize (S.A.P.), 22,210 bags, valued at	£12,323
Maize (not S.A.P.), 11,386 bags, valued at	9,891
Maize meal (S.A.P.), 7,778 bags, valued at	5,471
Maize meal (not S.A.P.), 900 bags, valued at	90

£27,775

TOBACCO.

The total area planted to Virginian tobacco was, according to the returns received, 9,007 acres, and the yield 2,880,104 lbs. Turkish tobacco had 1,167 acres given to it, and yielded 302,255 lbs.

The tobacco crops in all parts of the country suffered in a greater or lesser degree from drought in 1922, and many large areas had to be replanted, in some cases for the second and third time, only to flower at a few inches in height owing to lack of moisture.

Production of Tobacco, 1918-1922.

Season.	Virginian.		Turkish.	
	Acres.	Yield.	Acres.	Yield.
1917-18	2,434	415,210	813	204,961
1918-19	3,198	1,179,932	999	287,680
1919-20	5,546	2,435,994	1,958	511,633
1920-21	7,888	3,192,662	1,643	554,320
1921-22	9,007	2,880,104	1,167	302,255

Imports of Tobacco.

For the ten months ended 31st October, 1922, manufactured tobacco was imported as follows:—

Cigars and cigarettes (S.A.P.), 127,767 lbs., valued at ...	£69,248
Cigars and cigarettes (not S.A.P.), 4,214 lbs., valued at ...	3,374
Other tobacco (S.A.P.), 149,224 lbs., valued at ...	17,737
Other tobacco (not S.A.P.), 1,011 lbs., valued at ...	163

Total £90,522.

as against a value of £100,807 imported in 1921 during the same period.

Exports of Tobacco.

For the same period as the above the exports of tobacco were:— 2,106,387 lbs., valued at £156,163, as against 1,713,523 lbs., valued at £140,972, for the same period in 1921. Unfortunately the Trade Statements do not differentiate as to the kind of tobacco exported. The valuations shown were not the actual cash value of the tobacco, but the consignors' valuation for insurance purposes only, to cover themselves in the event of accident.

PUMPKINS AND CATTLE MELONS GROWN SEPARATELY.

The total area devoted to pumpkins only was 623 acres, which yielded 1,325 tons, or slightly over two tons per acre. Cattle melons had 288 acres devoted to them, and yielded 1,052 tons, or 3.6 tons per acre. The total quantities of pumpkins and cattle melons harvested, including those grown amongst maize, were 7,936 and 8,135 tons respectively.

POTATOES (Summer).

There was a marked increase in the area under potatoes in 1922. The total area planted was 2,827 acres, and the yield 36,811 bags, an average of 13 bags per acre. In the Salisbury district the average yield per acre was 21.7 bags of 150 lbs., and the total yield 25,262 bags, equal to 68.6 per cent. of the total production.

KAFFIR CORN.

Eight hundred and forty-seven acres were given to this crop, and yielded only 587 bags all told. The highest yield, viz., 3.2 bags per acre, was obtained in Hartley district.

RUPOKO.

Rupoko had 161 acres given to it, and yielded 196 bags. This grain is weevil-proof, and can be stored loose. It is excellent when cooked for fattening pigs, and is always in demand by the natives for the brewing of "mahewa," a light and wholesome drink. Rupoko should not be fed to poultry owing to its heating propensities.

RICE.

The season was not favourable to the growing of this cereal; 160 acres, however, produced 208 bags. The highest acre-yield, viz., 7½ bags, was obtained in the Gutu district. The prospects for rice warrant more extended cultivation and attention to this crop.

GROUND NUTS.

Taking into consideration the diminished rainfall in 1922, the yield of ground nuts was satisfactory; 5,432 acres produced 26,570 bags, or 4.8 bags per acre. The average yields in the Salisbury, Mazoe and Lomagundi districts were 6.3, 5.3 and 5.5 bags per acre respectively.

BEANS AND PEAS.

Beans were not a success, the average being under one bag per acre. Peas are not regarded as a staple or regular crop, and are grown spasmodically for the table and for market. As a green vegetable they are always in demand in the townships, and are looked upon as a luxury owing to their scarcity. Sixpence per lb. is the average price paid in the towns.

LUCERNE.

Two hundred and thirty-nine acres were returned, but it is more than likely that this figure includes fields of long standing. The new acreage planted was in all probability small.

FODDERS.

Of the fodder grasses teff continues to hold premier position in regard to acreage. The next in importance is millet, followed by Napier, paspalum, Kikuyu, Sudan and molasses.

BUCKWHEAT.

The yields were most disappointing. In few cases did the yield exceed one bag per acre. This grain usually has a ready sale at a payable price.

SUNFLOWER.

Although there were many failures owing to the drought, the yield was satisfactory; 2,722 acres produced 7,002 bags, or 2.5 bags per acre.

VELVET BEAN HAY.

The area planted to velvet beans was slightly less than in 1921, but the yield was, under the dry conditions, better in comparison; 1,825 acres produced 2,036 tons, or 1.1 tons per acre. 331 acres were planted for seed, and yielded 318 bags.

COW PEA HAY.

This crop fared badly.

SILAGE MAIZE.

The area returned from which silage maize was cut was double that of 1921. The 1922 figure is 12,408 acres, the majority of which was cut for silage when it was seen that the prospects of reaping any maize were doubtful.

IRRIGATED CROPS.

In regard to irrigated crops, the practice in the past was to call for returns in September of the estimated yields of crops then growing and about to be harvested. Last year the system was altered, and the actual return for the previous dry season's crops grown under irrigation or on naturally damp vleis was asked for. Some confusion seems to have resulted, and the returns received are in consequence incomplete and unreliable. For these reasons figures in regard to wheat, barley, oats and oat hay are not submitted.

WHEAT.

It may be of interest to give here the imports into and the exports from Southern Rhodesia of wheat and wheaten flour during the ten months ended 31st October, 1922:—

Imports of Wheat and Wheaten Flour.

Wheat (S.A.P.), 1,813,673 lbs., valued at	£10,760
Wheat (not S.A.P.), 559,904 lbs., valued at	3,035
Wheaten flour and meal (S.A.P.), 3,452,941 lbs., valued at	39,750
Wheaten flour and meal (not S.A.P.), 2,287,758 lbs., valued at	17,543
Total	£71,098

as against £80,234 for the same period in 1921.

Exports of Wheat and Wheaten Meal and Flour.

Wheat	Nil.
Wheaten meal and flour, 214,686 lbs., valued at ...	£3,688

as against 374,544 lbs., valued at £7,624, for the same period in 1921.

CITRUS ORCHARDS.

The figures given under this head in the returns do not appear to be reliable, as, apart from the fact that some returns were not received, it is apparent that, while the careful farmers counted their trees and ascertained how many were bearing, the majority merely filled in the return from memory—at best an unreliable method—with the result that a comparison of the 1922 figures with those of the previous year, besides showing no appreciable advance, actually records a diminution in the number of non-bearing trees. As an instance, in 1921 there were 150,027 orange trees, of which 100,858 were not bearing; in 1922 the total was only 141,989 all told, and while the bearing trees had only increased by 7,368, the number of non-bearing receded from 100,858 to 85,452. Assuming that a small percentage perished in 1922 from drought, grass fires or other causes—which deficiencies should have been more than covered by young trees—8,038 trees have not been accounted for.

Citrus Orchards, 1921-22.

	Trees bearing.	Not bearing.	Total.
Oranges	56,537	85,452	141,989
All other citrus trees	16,607	8,142	24,749

Total 166,738

The total for 1920-21 was 178,198.

TABLE II.

Districts in order of Acreage of Cultivated Land.

District.	1921-22.		1920-21.		1919-20.		1918-19.	
	(Sum- mer crops only). Acres.	Sequence.	Acres.	Sequence.	Acres.	Sequence.	Acres.	Sequence.
Mazoe ...	74,133	1	75,932	1	67,781	1	64,279	1
Salisbury ...	39,788	2	39,594	2	34,079	2	33,166	2
Lomagundi ...	23,956	3	21,864	3	17,938	3	15,533	4
Gwelo ...	16,676	4	17,164	5	15,777	5	15,525	5
Hartley ...	16,303	5	19,058	4	17,691	4	17,480	3
Makoni ...	6,133	6	5,690	8	5,409	7	5,614	8
Marandellas ...	6,062	7	6,128	6	5,912	6	5,670	7
Victoria ...	5,667	8	5,718	7	5,095	8	4,154	9
Bubi ...	5,333	9	4,224	11	3,991	10	3,815	14
Insiza ...	4,386	10	4,693	9	5,018	9	5,904	6
Bulawayo ...	3,841	11	3,830	12	2,948	15	3,438	13
Bulalima- Mangwe	3,124	12	3,297	13	3,579	11	3,281	15
Umtali ...	3,001	13	3,238	14	3,093	14	3,074	16
Selukwe ...	2,659	14	1,724	20	1,017	22	1,376	20
Nyamandhlovu...	2,389	15	3,205	16	3,225	13	3,500	12
Charter ...	2,148	16	4,598	10	3,571	12	4,094	10
Mrewa ...	1,507	17	1,727	19	1,200	21	1,211	21
Umzingwane ...	1,474	18	1,262	22	825	24	951	24
Chilimanzi ...	1,427	19	3,216	15	2,906	16	3,942	11
Matobo ...	1,339	20	1,783	18	1,586	18	2,129	17
Gutu ...	1,261	21	1,504	21	1,525	19	1,180	22
Melsetter ...	1,202	22	2,320	17	2,307	17	2,006	18
Wankie ...	1,093	23	1,152	23	837	23	1,081	23
Ndanga ...	923	24	1,136	24	1,363	20	1,559	19
Darwin ...	892	25	1,079	25	686	25	590	26
Belingwe ...	421	26	451	28	399	28	424	27
Gwanda ...	416	27	987	26	651	26	653	25
Sebungwe ...	158	28	164	29	...	...	...	...
Inyanga ...	157	29	506	27	593	27	183	28
Mtoko ...	80	30	20	30	61	29	98	29
Bikita ...	51	31	...	32	...	...	...	...
Chibi ...	...	32	4	31	31	30	20	30
	228,000	...	237,268	...	211,094	...	205,439	...

TABLE III.

Cultivated Crops in order of area in 1921-22.

Crop.	Acres.	Acre yield.			
		1922.	1921.	1920.	1919.
Maize	181,729	3.64 bags	6.55	6.45	5.13
Maize (silage)	12,408	2.1 tons	4.3	3.17	2.3
Tobacco	10,174	312.7 lbs.	393	390	350
Ground nuts	5,432	4.8 bags	8	6.8	6.2
Potatoes	2,827	13 bags	23	23	21
Sunflower	2,722	2.5 bags	5.8	6.7	3.6
Beans	2,568	.8 bag	3.2	2.04	1.4
Velvet beans	2,156	...	...	...	...
Teff grass	1,465	...	...	...	...
Kaffir corn	847	.6 bag	2.3	3.5	...
Sweet potatoes	692	10 bags	18.3	9.2	...
Millet (manna)	689	...	...	...	...
Cow peas	677	...	...	...	...
Pumpkins	623	2 tons	9	5.4	1.9
Napier fodder	610	...	...	...	...
Buckwheat	394	.6 bag	2.5	2.8	1.7
Cattle melons	288	3.6 tons	8.3	5.7	2.6
Paspalum	243	...	...	...	...
Lucerne	239	...	...	...	...
Kikuyu grass	198	...	...	...	...
Rupoko	161	...	...	...	...
Rice	160	...	...	...	...
Cotton	135	...	...	...	...
Sudan grass	132	...	...	...	...
Sundry vegetables	128	...	...	...	...
Linseed	114	...	...	...	...
Molasses grass	85	...	...	...	...
Peas	83	...	...	...	...
Swedes	11	...	...	...	...
Mangolds	7	...	...	...	...
Oats	3	...	...	...	...
	228,000				

TABLE IV.

Acreage in relation to Class of Crop, 1921-22.

Class.	Crop.	Acres.	Total acres.
GRAIN	Maize ...	181,729	183,294
	Kaffir corn ...	847	
	Buckwheat ...	394	
	Rupoko ...	161	
	Rice ...	160	
	Oats ...	3	
SUCCULENT AND ROOT CROPS	Maize (silage) ...	12,408	16,856
	Potatoes ...	2,827	
	Sweet potatoes ...	692	
	Pumpkins ...	623	
	Cattle melons ...	288	
	Swedes ...	11	
	Mangolds ...	7	
LEGUMES	Ground nuts ...	5,432	11,155
	Beans ...	2,568	
	Velvet beans ...	2,156	
	Cow peas ...	677	
	Lucerne ...	239	
	Peas ...	83	
FODDERS	Teff grass ...	1,465	3,422
	Milletts ...	689	
	Napier fodder... ..	610	
	Paspalum ...	243	
	Kikuyu grass ...	198	
	Sudan grass ...	132	
	Molasses grass ...	85	
VARIOUS	Sunflower ...	2,722	13,273
	Tobacco ...	10,174	
	Cotton ...	135	
	Linseed ...	114	
	Sundry ...	128	
			228,000

Tobacco Seed-Beds.

By H. W. TAYLOR, B.Agr., Tobacco Expert.

The production of strong, healthy seedlings for transplanting is the first step in tobacco production. This work is unfortunately looked upon by many tobacco growers as being elementary, and they therefore do not give their seed-beds the attention required. In point of fact the production of the necessary quantity of strong, healthy seedlings is one of the most important steps in tobacco growing, and failure in this operation often leads growers into difficulties. Every season there are a number of tobacco growers who are severely handicapped through not having sufficient transplants for their requirements or by being forced to use transplants which are unsuitable.

On account of the small size of tobacco seed, the seed-beds must be brought into a fine tilth in order to secure proper germination. Tobacco seed store up only small amounts of plant food, and for this reason the young plants are soon forced to draw their food supply from the soil. Consequently tobacco seed-beds should be in a high state of fertility and the soil should have an abundance of available plant food at the time germination takes place, and a sufficient store to maintain a steady growth of the seedlings until they are ready for transplanting into the field.

Types of Tobacco Seed-Beds.—The type of seed-bed used depends on the climatic conditions of the particular country in which tobacco is being produced. When the growing season is short and the spring months are subject to low temperatures, the tobacco seedlings are grown in greenhouses or in cold frames covered with glass. Fortunately the climatic conditions of Rhodesia render either of these expensive types of seed-beds unnecessary. The open frame type of seed-bed fulfils the requirements for this climate, and is considerably less expensive, besides being simple in construction.

Selection of Site.—The area selected for seed-beds should, if possible, be well sheltered from the prevailing winds. Strong winds dry out the surface of the soil, which necessitates additional work in watering, besides being harmful to the young tender plants. Water is the first requisite for producing tobacco seedlings in Rhodesia, and for this reason the seed-beds should be located near a permanent supply of water. When possible, the seed-beds should be near the homestead, so that they can be constantly under the supervision of the grower. Large trees should not be too near the seed-beds, as their roots would

deprive the plants of food and moisture, and might interfere with the growth of the seedling by casting too much shade.

The seed-beds should be located so that the plants will receive the maximum amount of sunlight, especially the sunlight of early morning. Rawson* has shown that the early morning sunlight is essential for the proper growth of certain plants, and the writer has noticed in many instances that this is true of the tobacco plant. For this reason an eastern, or north-eastern, exposure is best for tobacco seed-beds.

If the site selected is exposed to the winds, an artificial shelter should be erected. This can be constructed from the material on the farm, by using long grass or maize stalks, supported by poles and posts.

Soil.—The soil used for tobacco seed-beds must be well drained. If the soil becomes saturated with water, the plants do not make satisfactory growth and are also more liable to be attacked by fungus diseases. The very early beds can be located on the border of a vlel, but such locations are to be avoided for later sowings, for the reasons stated above.

The most suitable soils for seed-beds are sandy loams and alluvial soils which have good natural drainage. The soil should be fertile, and have a plentiful supply of humus.

If no proper soil can be found on a suitable area, much can be done to change the texture of the soil so that it may be used for seed-beds. Should the soil be too light and friable, a few wagon-loads of heavier soil or ant heap can be spread over the surface of the site and thoroughly mixed with the soil. This will in many cases produce the desired result. If the soil of the site is too heavy and stiff, a similar application of sand will render such soils friable and more suitable for tobacco seed-beds.

On many farms the soil near the only available water supply is inclined to be too wet. In such cases the only alternative is to provide drainage. If the land does not have sufficient fall, this may be extremely difficult, but a site can usually be found which can be properly drained. Time and money should not be spared to provide proper drainage, as the year's supply of plants depends on the proper construction of the drains. Generally speaking, open drains should be cut around the four sides of the site, and in addition a channel must be cut from the lowest corner to lead away all drainage water. Small drains are usually of no practical use, and are a waste of time and money. Open drains should be at least four feet wide and of sufficient depth to thoroughly drain the site selected for tobacco seed-beds. Negligence in the matter of drainage is often the cause of failure in the production of tobacco seedlings on many farms in Rhodesia. This applies to Turkish seed-beds more particularly, as they are sown later in the season.

Tobacco seed-beds should not generally be made continuously on the same soil. When the same site is used annually for seed-beds the

* *Transvaal Agricultural Journal*, vol. i., iv., No. 15.

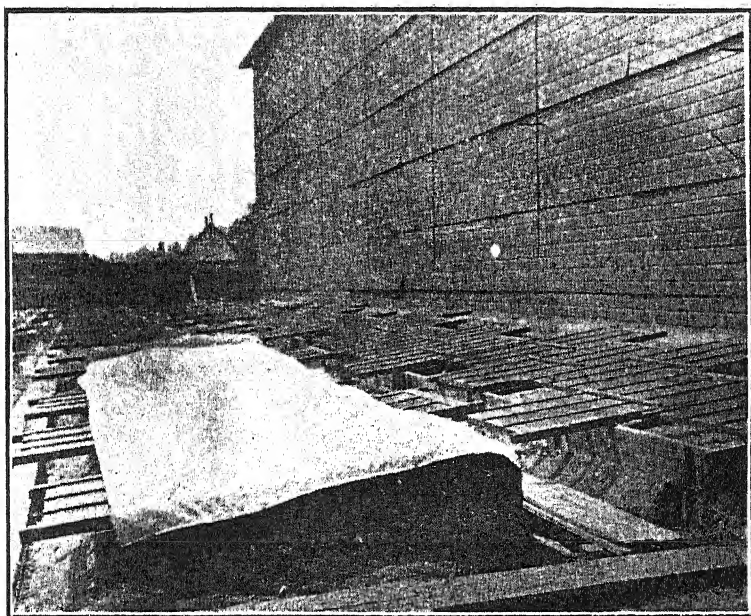


Plate I.



Plate II.

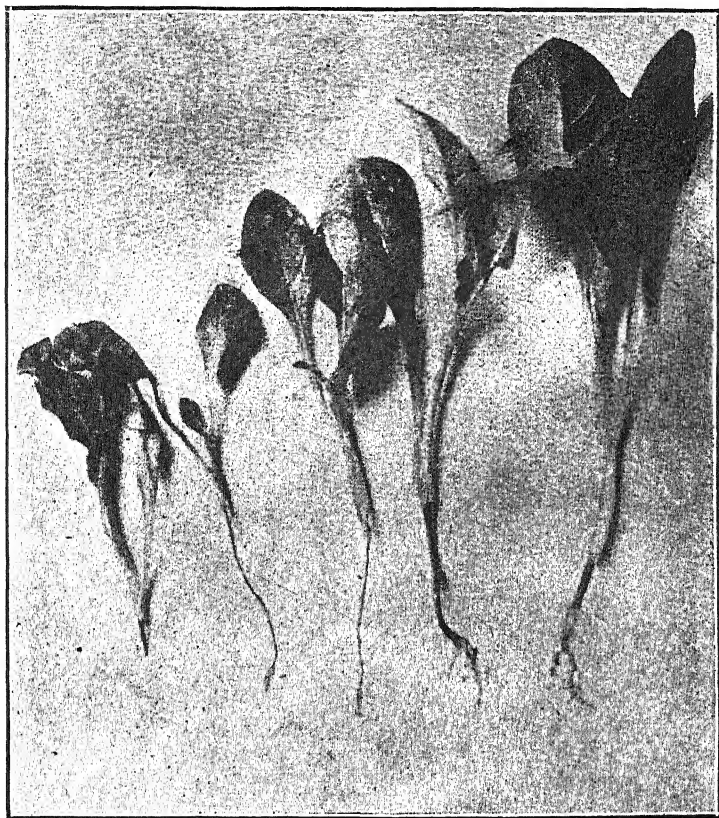


Plate III.—Damping off. From Bulletin No. 237, Agricultural Experiment Station of the University of Wisconsin.



plants are more liable to the attacks of insects and fungus diseases, and the soil is rendered less suitable through the heavy applications of water and the annual sterilising. New land is preferable, as weeds and grass are less troublesome, and the plants are not so much subject to the attacks of insect pests and fungus diseases. Some growers prefer to renew the soil each year in permanent seed-beds. If the site is sterilised annually, there is no objection to this practice.

Preparation.—The preliminary preparation consists in clearing the site of undergrowth and rubbish, and levelling the land. When this is done the soil should receive a liberal application of old well-pulverised kraal manure, which should be well incorporated with the soil by ploughing or spading. Kraal manure should be applied some time before the final preparation of the seed-beds in order that it may be thoroughly decomposed and converted into humus before the beds are seeded. If the soil is stirred at frequent intervals, most of the weeds will be destroyed before the final preparation of the beds and the remainder will be killed when the soil is sterilised.

In the final preparation the site is lined off into beds with pathways between. The size of the beds can be made to suit the site and the convenience of the growers. Beds can be made any desired length, but it is best to restrict the width to 4 to 5 feet, so that transplants may be removed from either side without damaging those left in the seed-beds. After the beds have been aligned, they should be sterilised before they are seeded.

There are several methods of sterilising the soil, but for Rhodesian conditions the open-fire method gives satisfactory results. By the burning process, weed and grass seeds are killed and insects hibernating in the soil are destroyed. The resulting ash is an excellent fertiliser for tobacco, as it contains carbonate of potash, which is the best form in which potash salts can be applied to tobacco. Also, Russell and Hutchinson have shown by experiments that, when soils are heated to 98° C. and then moistened with water, after a few days there is an increase in the available nitrogen content of the soil.

In burning tobacco seed-beds, sufficient brush wood, maize cobs or other material should be placed on the soil to thoroughly sterilise it to a depth of 3 inches. Tobacco stalks alone should not be used for this purpose, as the ash contains an excess of potash, which adversely affects germination. When the soil is properly sterilised it will have a light, dull red colour, and will be very friable and easily pulverised. A simple and efficient test is to bury a potato about 3 inches below the surface of the soil in the seed-bed, and when the potato has been cooked until the skin slips off easily, the soil has been properly sterilised. The soil should not be sterilised when saturated with water, and on the other hand the best results are not obtained when the soil is extremely dry. Soil containing just sufficient moisture for cultural operations is in the proper condition for sterilising by this method.

After burning, the beds are allowed to cool, and are then enclosed with boards, brick or sheets of iron. The unburned portions of wood

and large pieces of charcoal are next removed from the surface. The seed-beds are then ready for an application of fertiliser before digging them over. An excellent fertiliser can be made up of $\frac{1}{2}$ lb. of nitrate of soda, $\frac{1}{2}$ lb. of sulphate of potash and 1 lb. of superphosphates, which should be applied to 10 square yards of seed-bed. If these materials are not available, an equivalent amount of good tobacco fertiliser can be applied. After the fertiliser has been applied, the soil should be dug over to the depth at which it has been sterilised. The unsterilised soil should not be brought to the surface, as weed and grass seed would be exposed which would give trouble later. In digging over the seed-beds care should be taken to thoroughly mix the ash and fertiliser with the surface soil. The seed-beds are then brought to a fine tilth with the hand rake, care being taken to leave the surface of the beds level, both longitudinally and transversely. If the surface of the seed-beds is not level, there is danger of the tobacco seed being washed from the higher to the lower portions of the bed, which causes an uneven stand of plants, and this is undesirable. After the soil has been properly levelled and thoroughly pulverised, the seed-beds are ready for sowing.

Sowing.—A very common mistake is to seed too thickly. On account of the small size of tobacco seed, growers do not realise the numbers of seed contained in a given quantity. In one ounce of tobacco seed there are approximately 300,000 seeds, and an average teaspoon will hold about 25,000 when level full. If tobacco growers will keep these figures in mind, there should be a tendency to avoid this common mistake.

When shelled from the seed pods, tobacco seed contains a large amount of dust and chaff, besides a very high percentage of light inferior seeds. Before sowing, these impurities and inferior seeds should be removed by passing the seed through a tobacco seed separator. It is not expected that every grower will provide himself with the necessary apparatus for this work. Each grower can, however, send his tobacco seed to the Agricultural Department, where they will be cleaned free of charge, but carriage must be paid to and from Salisbury. It has been definitely established by practical and experimental results that tobacco produced from heavy, well-developed seed is more uniform in size and colour and produces larger yields than tobacco grown from ungraded seed.

If properly cleaned and graded seed are used, one ounce of tobacco seed is sufficient for sowing 120 square yards of seed-bed. Every farmer does not have a scale which will weigh fractions of an ounce, but the seed can be measured with sufficient accuracy with an ordinary teaspoon. In one ounce there are sufficient tobacco seed to fill an ordinary teaspoon level full twelve times. If an ordinary teaspoonful of tobacco seed is sown to 10 square yards the rate of seeding will be approximately one ounce to 120 square yards.

In order to evenly distribute such a small quantity of seed over the given area, some substance must be used as a distributing medium. It has been found from practical experience that wood ashes and mealie meal are the most satisfactory materials to use. Both are usually at

hand, and being white in colour they indicate plainly the evenness or otherwise of the distribution. The proportion of seed to wood ash or mealie meal is about one teaspoonful of tobacco seed to one quart of ash or meal. The seed should be thoroughly mixed with the distributing medium before sowing.

After sowing, the seed should be gently firmed into the soil to prevent washing. For this operation a plastering trowel, or similarly fashioned implement, can be used. Some growers give the seed-beds a light dressing of clean sand or leaf mould before firming the soil. This must be carefully done or the seed will be covered too deeply. Immediately after sowing, the beds must be watered with a sprinkling can, fitted with a finely perforated "rose," and should not be allowed to become dry until the plants are ready for hardening off for transplanting.

Time for Sowing.—No definite date can be laid down as to when beds should be seeded. Generally speaking, for early sowing, about 60 days from date of seeding the seedlings will be ready for transplanting into the field, and less time is required for later sowings.

Virginia tobacco should not be transplanted after the 1st of January, and if possible the whole of the crop should be established in the field by the end of December. It follows then that the beds to provide seedlings for transplanting during November and December should be sown from the 15th of September to the end of October. Turkish tobacco is best transplanted from the latter part of January to the end of February, so that seed-beds of this type of tobacco should be seeded from the first part of December to the middle of January.

All of the seed-beds should not be sown at one time, but should be seeded at intervals of about fourteen days. For Virginia tobacco sufficient seed-beds should be sown at one time to provide transplants for at least 20 acres, so that a sufficient area can be transplanted at one time to furnish enough ripe uniform leaf for the first curings. When this practice is followed, the several operations of cultivation and curing can be carried out in succession and labour can be used to better advantage.

The area of seed-beds required depends on the size of the intended crop and the type of tobacco grown. For Virginia varieties about 20 square yards will be sufficient to provide transplants for one acre, but for Turkish varieties 100 square yards of seed-bed should be seeded for each acre to be grown.

Covering.—In the early stages of growth, tobacco plants are very tender and delicate. Frost at night and hot sun during the day are both injurious, so that some covering must be used to protect the young plants from the extremes of heat and cold.

Two covering materials are available: grass and cheese cloth. The latter is preferable for a number of reasons.

Grass is difficult to manipulate in order to give the seedlings the proper amount of sunlight. If the grass covering is too thick, the

plants are inclined to be lanky and weak. If too thin, the young seedlings are often killed by the surface soil becoming too dry. Again, grass does not protect the seedlings from insect attacks. Some growers maintain that grass coverings are considered cheaper than cheese cloth, but this is a point in question. If the additional labour required for cutting and cleaning the grass, for constructing the covers and manipulating same is taken into account, it will be found that there is practically no difference in cost. Grass coverings also often harbour the moths of the tobacco splitworm and tobacco stem borer, both of which may cause severe damage to the young plants and in some cases completely destroy the seed-beds.

Cheese cloth is the most suitable covering for seed-beds which has yet been found. It protects the young plants from insect attacks if properly used; it protects the young seedlings from the direct rays of the sun, and at the same time affords sufficient sunlight for proper growth. If the beds are properly enclosed, cheese cloth will keep the beds warm at night, by retarding radiation, which hastens the growth of the seedlings. This form of covering is not expensive, and will greatly assist the grower in the production of strong healthy transplants.

If procurable, the writer advises every tobacco grower to use cheese cloth for covering tobacco seed-beds. Should cheese cloth be unprocurable at a reasonable price, light weight, coarsely woven hessian can be used.

Insect Pests.—In case the plants in tobacco seed-beds are attacked by insect pests, growers should adopt the remedial measures recommended in Bulletin No. 347, issued by the Agricultural Department, which deals exhaustively with the subject of insects attacking tobacco.

Diseases.—The three principal diseases which attack tobacco plants in the seed-beds are "Damping Off," "Wildfire" and "Angular Spot."

Damping off.—The rapid rotting of plants in the seed-beds is usually termed "damping-off." This disease is caused by fungi (*Rizoctonia*) which thrive under certain conditions in and upon the stems of young plants. The disease usually starts on the stems of the plants near the surface of the soil and spreads upwards to the young leaves. As a result of the disease, the stems become weak and the young plants fall down in a tangled mass and probably die or become useless for transplanting. If the plants are very small when the disease appears, the only noticeable effect is a yellowing and dying-out of the plants, leaving a patchy uneven stand.

If the disease appears in the seed-beds, watering should be reduced to the minimum and the covering removed to accelerate the evaporation of excessive moisture. The plants in the affected spots, together with the surface soil, should be carefully removed and the spots dressed with dry clean sand. Bordeaux mixture also helps to keep the disease in check. Sowing seed too thickly and excessive watering of the beds are the principal factors in inducing damping-off. Crowding of plants in the seed-beds renders them more susceptible, while properly spaced plants are seldom attacked.

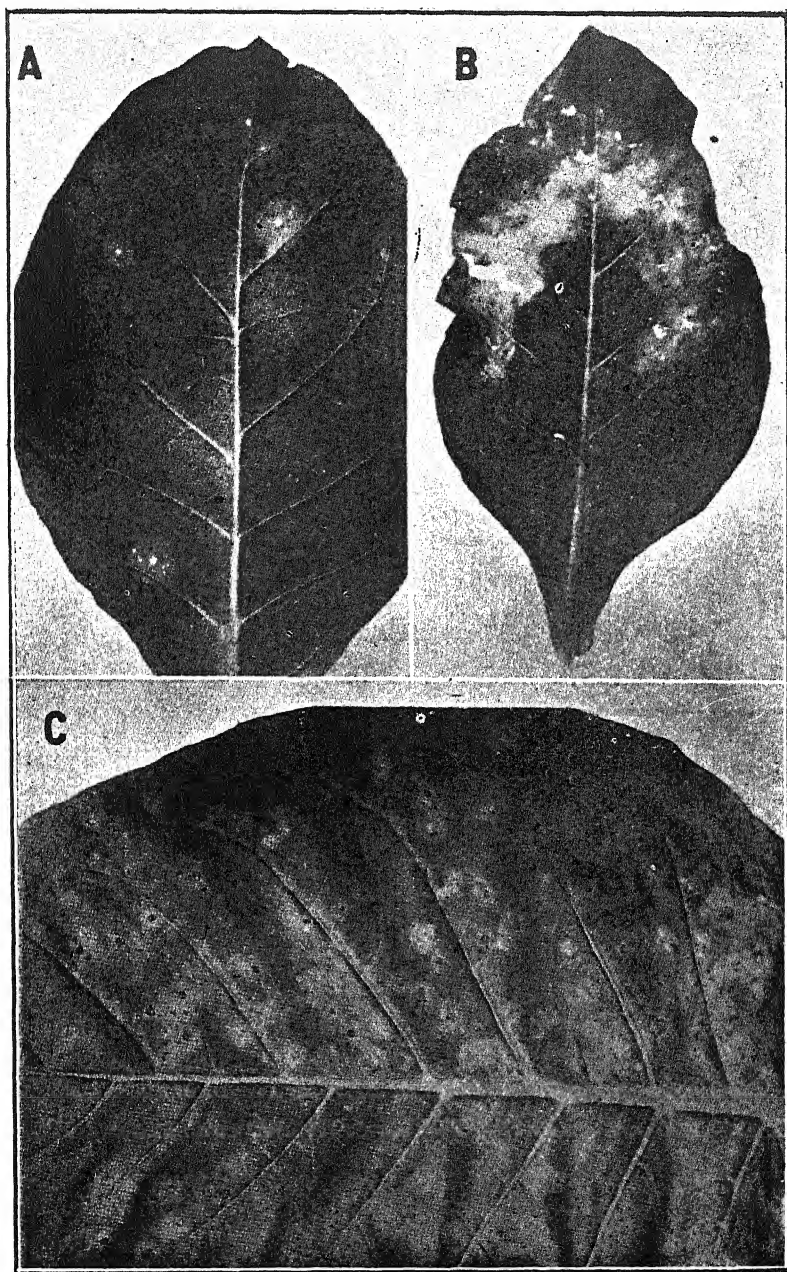


Plate IV.

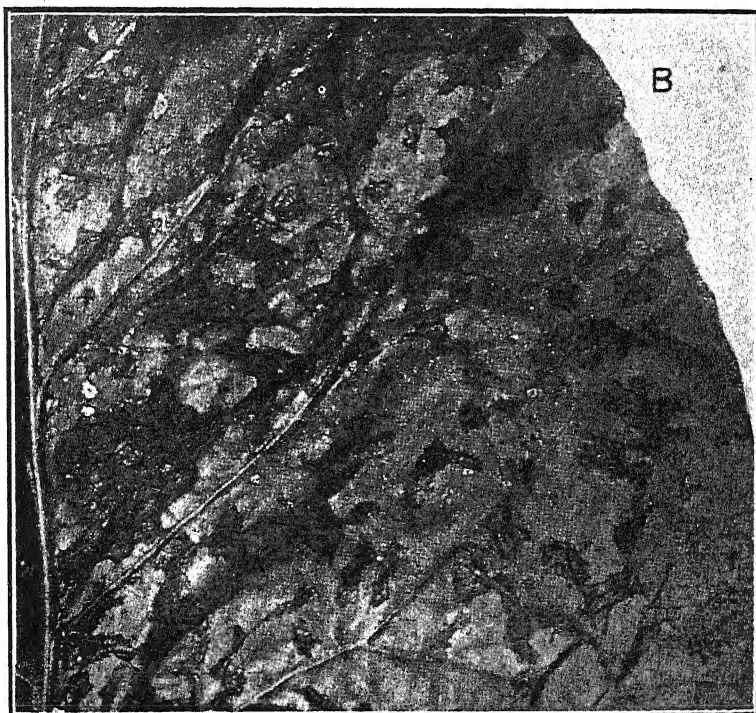
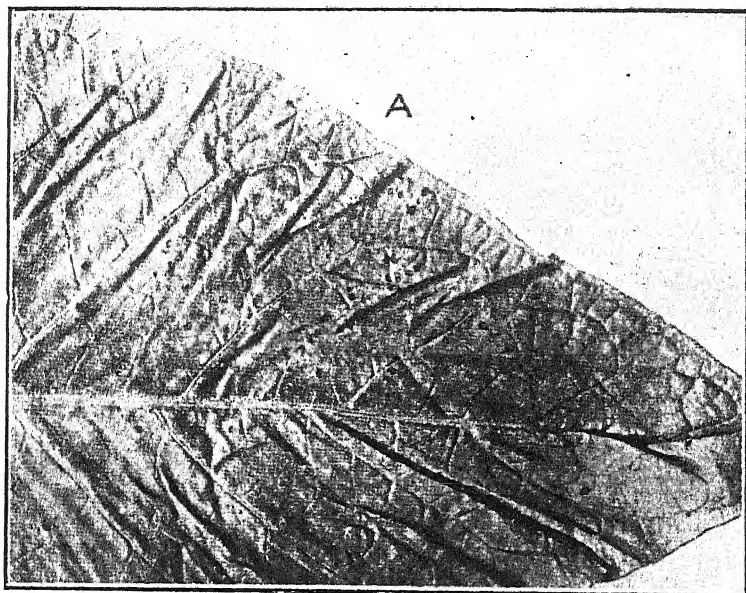


Plate V.

Beds in which the disease has appeared should not be again used until the soil has been thoroughly burned to a depth of 3 to 4 inches and afterwards treated with formalin diluted to 1 gallon to 50 gallons of water. The seed-beds should be properly dug over, and the soil then treated with the formalin solution at the rate of two quarts per square foot. The soil should then be covered with old bags or hessian to prevent the too rapid evaporation of the formalin fumes. The soil should be given one week to dry out before seeding, in order that germination of the seed may not be impaired.

Wildfire and Angular Spot.—Wildfire and angular spot are related diseases in that both are caused by parasitic bacteria. The former is caused by *Bacterium tabacum* and the latter by *Bacterium angulatum*. Both diseases cause wide-spread damage in certain seasons, and both can generally be traced back to the seed-beds.

Fromme* states that "it has been found that both diseases occur on plants in the seed-beds, and that the amount of disease which develops in the field is determined in a large measure by the amount of disease found in the beds. The problem of control centres on the seed-beds. If these can be kept free from disease, the chances of loss in the field are slight.

"Infection in the seed-bed usually comes from one of three sources: the seed, the cover or the soil. Of these, the seed is undoubtedly the most common and important source. Both diseases are found on seed pods as well as on the leaves. Seed treatment is, therefore, necessary to ensure against introduction of the disease into the beds on seed.

"Even though the seed be free from disease, infection may be introduced by the cloth cover or the soil. Next to the seed, the cover seems to be most important. If an old cover that has been used on an infected bed the previous year is employed, it is quite probable that some of the disease bacteria will be retained on it and serve as a source of infection for the new crop." If old covers are used, the cloth should be thoroughly sterilised by boiling in water or treating same with a solution of formalin.

"Although it has not been proved that the bacteria can live over in the soil of plant beds, it is quite possible that some infection may come from this source. It is highly advisable as a precautionary measure that new beds be made up each year."

Chapman and Anderson† state that, "with regard to liability of wildfire infection, our observations have been that it has made little or no difference whether or not seed-beds have been sterilised. It is, however, a good practice, and will minimise the chance of infection from material containing the organisms which may have remained in the beds."

* Bulletin No. 62, Virginia Agricultural Experiment Station, Extension Division.

† Bulletin No. 203, Department of Botany, Massachusetts Agricultural Experiment Station.

All authorities agree that the chief measure of control is the use of disease-free seed. Disease-free seed may be obtained from fields entirely free from either disease or by treatment which will destroy the bacteria without injury to the seed. Even though the seed is thought to be free from disease, treatment is desirable as an extra precaution. Treatment is very simple, but must be properly carried out to obtain satisfactory results. The seed should be soaked for 15 minutes in a solution of formaldehyde. The solution is made by adding one ounce of 40 per cent. formaldehyde to one pint of water. The seed should be stirred or shaken in the solution throughout the 15 minutes, after which the seed is washed of all traces of formaldehyde and thoroughly dried. Chapman and Anderson state that "this treatment will not eliminate the possibility of the occurrence of the disease (wildfire) in the seed-beds, for some of our seed-bed infection this past season occurred after the plants were well developed, but it will eliminate one source of infection, and if the other recommendations are followed will reduce the chances of infection."

Chapman and Anderson have carried out experiments with reference to the control of the diseases when occurring in seed-beds, and found Bordeaux mixture, either as a dust or spray, to be very effective. They recommend that beds be sprayed or dusted weekly from the time the plants are the size of the thumb nail until setting is completed. The same authorities give condensed recommendations for control as follows:—

1. Save seed only from disease-free plants.
2. Sterilise seed.
3. Sterilise seed-beds with steam or formaldehyde, or, when the disease has been in beds the previous year, change the location if practicable.
4. Spray or wash sash, plank or cloth with formaldehyde.
5. Spray or dust beds with fungicide weekly from the time the plants are the size of the thumb nail until setting is completed.
6. Water beds only sufficiently to keep plants growing. Ventilate thoroughly.
7. Set plants from disease-free beds only.
8. If badly diseased plants are found in the field, remove and destroy them.
9. If infection in the field is light or occurs late in the season, pick and destroy diseased leaves when they are not wet from dew or rain.
10. As far as possible avoid working in the tobacco when the leaves are wet.

Care of Seed-Beds.—In order to obtain satisfactory results, tobacco seed-beds must be given constant care. If neglected for a few days, the seedlings may be destroyed by insects or lack of moisture and the season's crop may be lost or seriously retarded.

The seed-beds should always be kept moist, but not wet. Water should be applied with a watering can and not by irrigation. During germination and the early stages of growth the watering can should be fitted with a finely perforated "rose," in order that the seed may not be displaced or the soil washed away from the roots of the small seedlings. When the leaves of the plants are the size of a shilling a "rose" with larger perforations can be used, and after the plants have become firmly rooted the "rose" may be removed from the watering can in order to facilitate the work. Should weeds and grass appear in the seed-beds, they should be removed, as they deprive the young plants of food and moisture, besides causing them to grow long and lanky through overcrowding and lack of sunlight.

During the early stages of growth the cheese cloth covering should remain on the seed-beds during the whole of the day, being removed only during the time the beds are being watered. Later the cheese cloth is removed for a short time each morning to give the plants more sunlight, which prevents thin weak stems. The period of exposure is gradually increased as the plants grow, and when they reach the desired size for transplanting the covering is removed during the day, but replaced at night to prevent insect injury. This procedure is necessary to harden the plants, in order that they may better withstand the shock when transplanted. After the plants are large enough for transplanting, they should be given only sufficient water to prevent excessive wilting. Just before the transplants are removed the seed-bed should be thoroughly moistened with water, so that the plants can be easily removed without injury. After all suitable plants have been removed the beds should be again watered, to firm the soil around the roots of the remaining seedlings in order that their growth may be retarded as little as possible.

Under certain conditions the plants in the seed-beds fail to make satisfactory growth. Upon investigation it will usually be found that the lack of growth can be traced to insect pests, water-logged soil, lack of plant food or overcrowding. In the latter case the obvious remedy is to remove sufficient plants, so that those remaining will receive sufficient air and sunlight to produce a healthy growth. Thinning also loosens the soil, which assists soil aeration and stimulates growth. If the soil is water-logged through the application of too much water, the amount should be decreased and the soil lightly stirred. It may happen that water-logging is due to insufficient drainage, which should be provided at once. Lack of plant food is usually indicated by the colour of the plants, which usually have a sickly, yellowish appearance. When plants turn yellow through lack of plant food, nitrogen is usually the element required. This can be supplied by using nitrate of soda or fowl manure. The latter is cheaper and should be available on every farm. Fowl manure is best used as liquid manure, but can be applied dry if finely pulverised. When used as a liquid manure the mixture is prepared as follows:—Fill any suitable receptacle about half full of fowl manure and then fill with water. Allow the mixture to stand for several days, stirring same at regular intervals. After about five or six days the manure is ready for use, and should be

applied at the rate of one gallon of liquid to eight gallons of water over an area of about 10 square yards. After a few days a second application should be given. Fowl manure is preferable to nitrate of soda, as it contains phosphates and potash as well as nitrogen. Nitrate of soda is used at the rate of one pound to eight gallons of water, and the solution can be applied immediately. The usual tobacco fertiliser, of good quality, can also be used to good advantage for stimulating the growth of backward seedlings. This is usually applied broadcast over the beds at the rate of one pound to 10 square yards. After applying any of the above, the seed-beds should be watered to wash the solutions or fertilisers from the plants to prevent the leaves from being burned.

When possible, application should be made on a dull cloudy day, as such weather reduces the risk of the leaves being scorched.

Failure in the production of strong, healthy seedlings for transplanting almost every season causes either the curtailment of the tobacco crop or forces growers to use unsuitable transplants. Moreover, the lack of plants for transplanting at the proper time is the cause of the production* of a large amount of late inferior tobacco, which would be almost unmarketable in other tobacco-producing countries.

It is felt that, if all tobacco seed-beds were properly prepared and diligently cared for, a great step forward would be made in tobacco culture.

Production of Maize.

By C. MAINWARING, Agriculturist.

The maize or mealie plant is a coarse strong-growing annual grass, grown chiefly for grain which is used both for human and live-stock food. It is also one of the best, if not the very best, crop that can be grown for silage. It holds first rank among the agricultural products of Rhodesia, both in areas devoted to its cultivation and in the value of the annual crop. This is perhaps not to be wondered at, considering the suitability of the soil and climate of Mashonaland, where the commercial crops are produced. In Matabeleland, where the seasons are sometimes short owing to the lateness of the rains, only sufficient maize is cultivated for home use.

The following tables give the production of maize from 1916-17 to 1920-21 :—

Season.	Acres.	Bags (203 lbs.).	Yield per acre.
1916-17	203,150	938,130	4.62
1917-18	192,148	591,722	3.08
1918-19	173,313	889,969	5.13
1919-20	173,467	1,120,548	6.45
1920-21	186,246	1,220,768	6.55

The highest yields in 1921 are as follows, from the three leading maize districts in Mashonaland :—

District.	No. of acres.	Yield per acre (bag of 203 lbs.).
Mazoe	67,846	9.3
Lomagundi	18,096	7.3
Salisbury	30,036	6.1

Climatic Conditions.—A liberal rainfall, with warm nights throughout the growing season and less moisture during the last month preceding maturity, constitute ideal weather for the crop. The average rainfall throughout Rhodesia is usually more than sufficient to supply the needs of the crop, but the distribution is as important as the amount. The commonest need of the maize crop in its development is moisture; especially from the time the plants commence to tassel, any check from this cause will be shown in the yield.

Preparation of the Soil.—Preparation of the land so that it will retain large quantities of water for longer periods is very important,

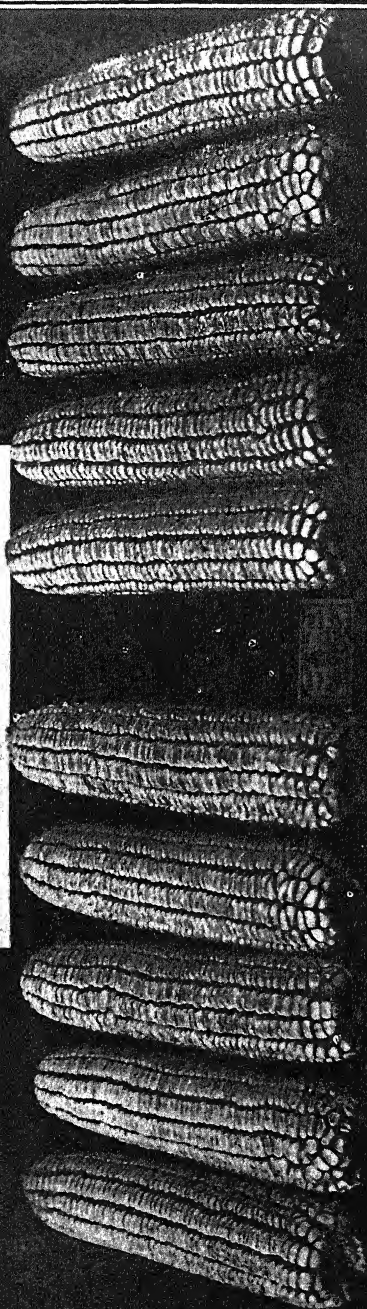
and will give greater returns on the investment than any other one item in the crop culture. The soil adapted for maize is a deep loose loam, well drained and well supplied with organic matter and plant food. February, March and April are the best months of the year in which to break up new lands, when the ploughing can be done most economically, for the weather is cool, the oxen are in good condition and the ground is generally in the best order. The first ploughing of new land should be from 8 to 10 inches deep, if the sub-soil will permit. While it is obviously impossible to lay down a hard and fast rule as to the date by which ploughing should be completed, farmers would be well advised to spare no effort to break up new land by the end of April; then let the land lie fallow for five months, and cross-plough again before planting. The nature of our climate is such that, on any but moist sandy vleis, it is frequently impossible to plough land to an adequate depth after mid-winter and until the general rains of the coming season.

It is often stated that the ploughing of old maize lands is delayed as long as possible on account of the winter feed they afford. Better and more valuable winter feed can, however, be secured by cutting and stooking the maize when the grain on the ears is dented or glazed, but before the leaves of the plant are brittle and quite dry. By this method the farmer is able to commence ploughing between the stooks while the soil is still moist. The ground upon which the stooks are built can be ploughed immediately the picking or husking of the ears is completed, the stalks being carted away and stacked in paddocks or alongside the kraals, to be fed to the cattle.

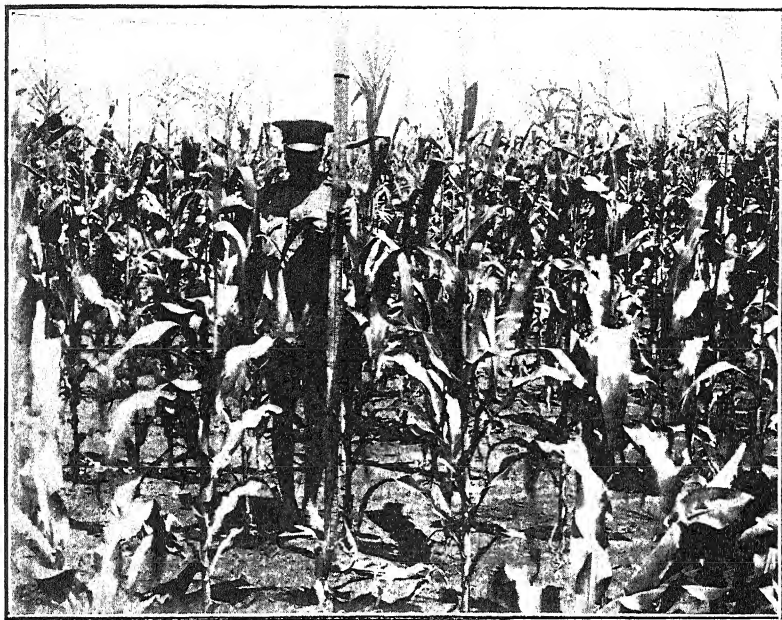
No object is served by leaving the land unploughed until the commencement of the new season, and accordingly it should be broken up without delay. If this is done, the roots and weeds on the land will be decomposed and converted into available plant food by the time the new crop is sown. If early ploughing were more generally practised, it would unquestionably reduce the prevalence of insects, particularly cutworms and stalk borer, because early ploughing buries the vegetable material in which these pests live during winter. Sometimes it is necessary to cross-plough old maize fields before planting, and this is usually very beneficial also in destroying weeds on badly infested lands. The disc or drag harrow should follow closely the second ploughing, or the sun will bake the clods so hard that they cannot be crushed without a great deal of extra labour. The soil should be thoroughly pulverised, and this may be done shortly after a shower of rain while the clods are still soft. After this work has been completed, the soil should be mellow to a depth of 6 to 8 inches and the surface smooth and even.

Planting.—The long season in Rhodesia allows considerable latitude for the planting of maize. The question is frequently raised whether planting should commence with the first rains (which may be expected from the middle of October to the first week in November) or later (mid-November to mid-December). In considering the question, the stalk borer and cutworm are influential factors. From observations these

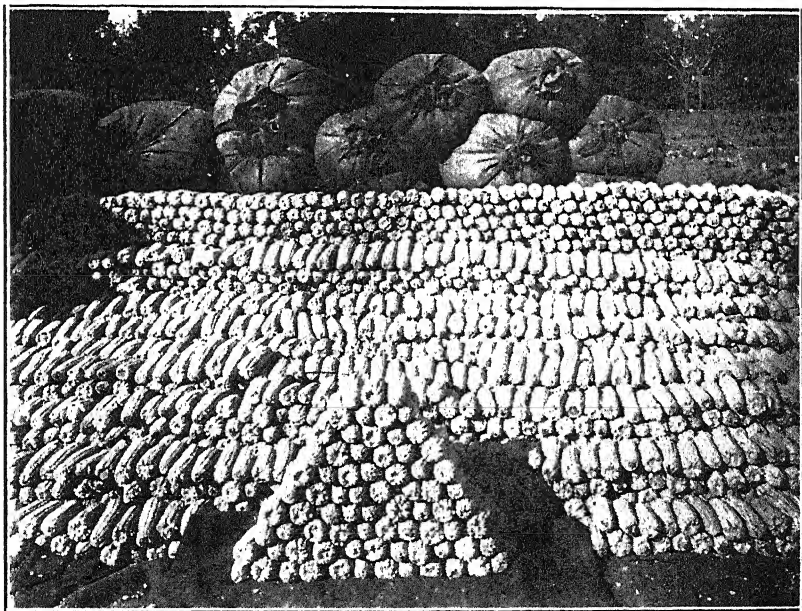
SALISBURY WHITE 12-ROW



A good exhibit of Salisbury White.



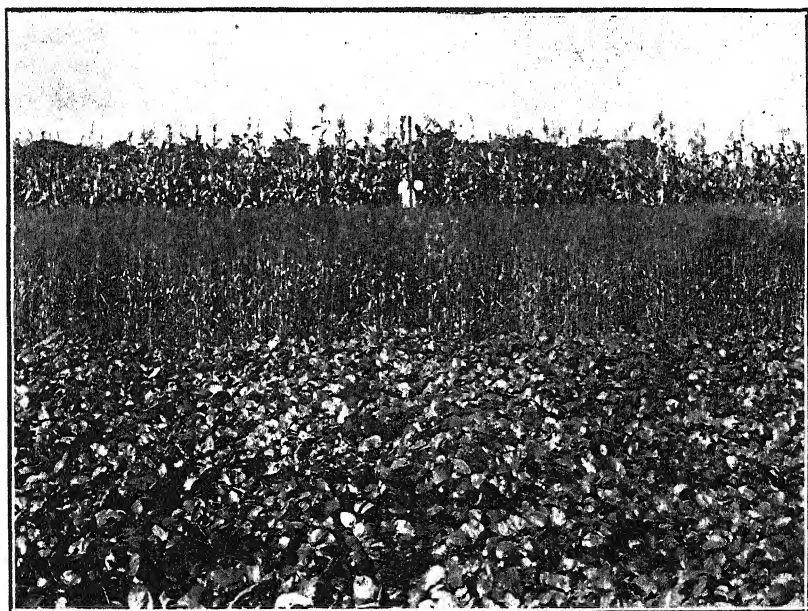
Maize continuous for eight years.



Selection of Salisbury White seed maize at Gwebi Experiment Farm.



Maize following velvet beans.



Crops in rotation with maize.



pests appear more abundantly during the first two weeks of November, though this period varies with the latitude and the weather. It seems to be the general opinion amongst growers that early planted maize may be relied upon to give the best results, though there is still some difference of opinion on the subject. At the Salisbury Experiment Station a series of experiments have been carried out to determine the date of planting that will give the best results. These have consistently shown that, weather conditions and soil conditions being favourable, the heaviest yields are obtained from the earliest planting the season permits.

The early planted maize makes a slower and tougher growth, and is not so susceptible to drought as maize planted later and growing more rapidly. It is also better rooted, should a spell of drought overtake it in January or February, and may be even mature before the drought becomes severe.

Distance Planting.—Rainfall and climatic conditions vary so much in different parts of the country that it is impossible to state the exact rate of seed which will give the best results in any particular season. For the present only a general approximation can be given. Experiments have been conducted at the Salisbury Experiment Station during the past two years to determine the effect of distance planting on yield of grain and fodder for silage. The maize crop of 1921-22 was so severely checked by the worst drought on record that the results secured mean but little, and only the results obtained in 1920-21, which was a normal year for the maize crop, are given below:—

Distance of rows apart.	Distance of plants apart in the row.	Yield of grain per acre.	Weight per acre of green fodder.
40 inches	6 inches	1,800 lbs.	28,800 lbs.
40 inches	9 inches	2,030 lbs.	29,400 lbs.
40 inches	12 inches	2,240 lbs.	28,700 lbs.
40 inches	15 inches	2,820 lbs.	32,000 lbs.
40 inches	18 inches	2,390 lbs.	32,040 lbs.
40 inches	24 inches	1,840 lbs.	23,930 lbs.

It was noticeable that the crowded stalks were thinner and produced a better quality of fodder, but the ears were fewer and much smaller. The wider spacing caused a stronger growth of stalk and a better quality of grain. The figures here given indicate that in a favourable season the heaviest yield of grain may be obtained from rows 40 inches apart with plants 15 inches apart in the rows, which is more or less the generally accepted distance.

In spite of all care taken in rate of seeding or distance planting, it is generally found that the stand of plants is very much below that desired. Our greatest losses are due to blank spaces, seen to a greater or lesser extent practically on every farm. It is usually estimated that the average stand of maize throughout the Territory does not exceed 60 per cent. of plants, and many fields fall much below this. The chief causes for the blank spaces are commonly faulty seed (machine threshed), improper soil conditions and cutworm. Planting maize by

hand is being done on a large scale by some of our most progressive men, with great success. The operation is performed with lengths of wire, which is knotted at regular intervals of 36 inches, or according to the distance desired for spacing the seed, throughout its entire length. The wire is staked at each end of the field, and natives go along with hoes and plant a couple or more grains against each knot. If the ground surface is level and the wire is accurately moved each time, so that the hill of each row comes in line with the first hill of the preceding rows, then, when planted, the field will be well "checked" and the maize may be cultivated in several directions. In spite of all precautions in planting, it may be found that the stand is much below that desired. The question then arises whether the missing grains should be re-sown or whether the whole field should be re-planted. Very little success has been gained by re-planting misses. In the first place, the re-fills never catch up with the original planted field; they are usually dwarfed and weak in growth, owing to their being robbed of plant food, moisture and sunlight by their more vigorous neighbours, and they rarely produce ears of any size or sufficient extra grain to compensate for the trouble of re-planting. If the actual stand is less than three-quarters the required stand, it will be advisable to re-plant the entire field at once.

Cultivation.—The chief objects of cultivation are to conserve moisture and prevent growth of weeds. The latter take up moisture and available plant food which should go to nourish the crop. The preservation of a soil mulch to conserve moisture is more or less important where rainfall is deficient. A definite rule cannot be given as to the number of times it will be necessary to cultivate the crop. It is a question largely determined by weather conditions. In some seasons two cultivations may accomplish as much as four in another season. Cultivation should not be delayed until the weeds are large enough to prove troublesome. It takes but little stirring of the soil to kill weeds immediately after they germinate. But a protracted rainy period may give the weeds such a start that they cannot be destroyed by shallow cultivation. This is about the only occasion when deep stirring is necessary or advisable. With few exceptions, weeds can be held in check by shallow cultivation as well as by deep cultivation, provided proper implements are used. Some farmers favour the shovel plough to destroy weeds. This practice is not advisable, since a ridged surface causes evaporation to take place, also the surface roots are injured or exposed, and the weeds are not destroyed, but simply checked by smothering.

When the rainfall is too plentiful, however, ridging land that is inclined to become water-logged assists drainage and protects the maize. If cultivation is necessary after the plants have attained sufficient height to shade the ground and the root system has occupied practically all the soil between the rows, it should certainly be shallow and not close to the plants, or more harm than good will result.

Rotation.—Proper rotation is now recognised to be a necessity to maximum production and efficiency with all crops. In fact, it is quite

as important to the permanent welfare of the soil as to the yield and quality of the plants grown, and the kind of rotation practised will have fully as much influence on both as does cultivation or fertilisation.

RESULTS OF ROTATION EXPERIMENTS AT SALISBURY EXPERIMENT STATION, 1914-22.*

Old Series.

	Average yield of 203 lbs. per acre for past eight years.	Maize yield in 1922. Rainfall, 16.82 ins.
Maize continuous	7.80	3.68 bags.
Maize alternate with fallow	12.45	12.26 bags.
Maize in three-course rotation	14.06	13.75 bags.
Maize in four-course rotation	17.63	11.20 bags.

New Series, started in 1919.

	Maize yield in 1922.
Maize continuous, three years	13 bags.
Maize after maize, dunged in 1920-21	14.35 bags.
Maize after maize, dunged in 1921-22	15.65 bags.
Maize after Sudan grass, 1920-21	13.95 bags.
Maize fertilised, 1920-21	11.75 bags.
Maize fertilised, 1920-22	12.80 bags.
Maize after velvet beans ploughed under, 1920-21	14.15 bags.
Maize continuous, three years	11.75 bags.

The benefits of rotation are very clearly demonstrated in the above results. Manure is the foundation of successful agriculture. Any substance added to the soil to render it more fertile may properly be termed a fertiliser or manure. In Rhodesia rotation on a large scale is often impracticable, owing to the fact that many of the crops advised for rotation with maize cannot be marketed for cash to advantage. But, wherever possible, alternating other crops with maize should be practised. The roots of certain crops, like sunflower, enter the soil deeper than others; these aerate the sub-soil, and when the crop is removed remain in the ground to rot. Proper rotation is also an excellent preventative against fungoid disease and insect pests. Weeds too are checked and sometimes eradicated by this means.

Varieties.—Unlike other maize-producing countries, the varieties grown in Rhodesia are not numerous. The following are the only ones grown in Mashonaland: Hickory King, Louisiana (10-row Hickory), Salisbury White, and on a smaller scale Potchefstroom Pearl of recent introduction from the Union. In Matabeleland, where seasons are sometimes short owing to the lateness of the rains, earlier maturing and hardier varieties, such as perhaps Silver Mines, are recommended, the

* *Rhodesia Agricultural Journal*, 1921-22.

grain being as suitable for stock feed as that of the varieties mentioned above.

Seed.—The quality of the seed may be improved by continual careful yearly selection. An ear of maize should be of good length, preferably 9 to 10 inches. Ears of this length should have a circumference of from $7\frac{1}{2}$ to 8 inches, should have straight rows, and not taper too much. The ears should be of uniform type of grain, as this indicates good breeding, and the grains should be of good depth and wedge-shaped, which ensures a large proportion of grains. The core should be of medium size and the grain should be of uniform colour.

Topping Maize.—It is a common practice to top the stalks by cutting them just above the ear. By this method the portion of the stalk which is eaten most readily and with least waste is obtained. If the ears have become hard, the kernels dented and the husks partly dry before the topping is performed, no reduction in yield will result. Ordinarily, however, it is found more expensive to top a crop than to cut and stook the entire plant.

Harvesting Maize.—The stage of harvesting or stage of maturity depends upon the product desired. For silage, maize is cut after the grain is set and the plant still green. For grain, maize is left until some time after becoming mature. In the chief maize-producing districts of Mashonaland maize is primarily grown for grain; the harvesting from the field is done exclusively by hand, and for that purpose extra native labour is generally employed. A system of harvesting practised by some of our leading growers, and one to be recommended, is to cut and stook the maize. This method enables the farmer to plough for the coming season while the ground is still moist. There have been no machines invented for harvesting maize as yet that offer much advantage over harvesting by hand, when labour is available and cheap.

From Breeder to Butcher.

CATTLE FATTENING EXPERIMENT NO. 11, GOVERNMENT EXPERIMENT FARM, GWEBI.

By ERIC A. NOBBS, Ph.D., B.Sc., F.H.A.S.

The practice of fattening oxen during the winter by artificial feeding is steadily, if slowly, gaining ground in Rhodesia, and it only awaits a more ready demand for such prime cattle for this system to be adopted on a very large scale by farmers in the arable districts. During the past seven years, and in preparation for the time which must come, the best methods of fattening stock have received attention at the Government Farm, Gwebi, and the general lines are now more or less definitely laid down. Over 250 head have been fed and their progress chronicled. Year by year numbers of cattle are fattened at the Gwebi Farm, there being no stud herd to consume the products grown, such as is generally found in similar public institutions in other countries.

This year it has been shown that it is quite possible to fatten in succession two lots of cattle, and from this it follows that the season for putting such stock on the market may be made to last over four months of the year.

The cattle used in these experiments, as in past years, have been three-and-a-half-year-old oxen bred from Shorthorn and mixed grade cows by Shorthorn bulls, therefore predominantly of that breed and of a class better than is generally met with, but of which there are happily every year more and more to be found on many farms. They came down from their mountain homes at the end of the grass season in fair store condition. A number were at once put into the yards to fatten; the rest were allowed to graze, with access to old lands, and fed in cribs before being penned to fatten. In this way a practical test was given of the practicability of feeding two lots of cattle during the winter season on an arable farm where maize is the leading crop, but other crops are grown in rotation in order to maintain and enhance the fertility of the soil, and to secure heavier crops per acre when maize is grown. It has been shown to be quite possible to fatten two lots in this manner, thus lengthening the season over which such cattle

are put on the market. The cattle were sold, too, in small lots as they matured, not all kept for one market, nor were the best reserved for the Christmas sales and kept on after they had reached their best.

In these experiments one aim has been to avoid the use of the more costly foodstuffs, and so far as possible of all such as can be sold off the farm in their original form. Though, of course, to do entirely without such feed as maize, beans, sunflower and ground nuts is impossible, yet it is not necessary to feed the best qualities or commercial grades, so long as the food is sound, wholesome and sweet. The main objects, however, were first to feed two lots in one season, and to ascertain which were the more economically fattened—those which were immediately stall fed and finished off before the end of August, or those which were fed on the farm, but not stalled until the others were disposed of, and which accordingly would not be prime fat till November or December.

It will be convenient to consider fully the first lot before dealing with the second.

The weight of each animal was taken weekly. The ration was fed, not per head, but per 1,000 pounds live weight, according to the weight of each pen for the week. Twenty animals were distributed in three pens, and on 3rd May their initial weight was 21,283 pounds, an average of 1,064 pounds each. Nothing is to be gained by tabulating the individual weights of each beast weekly during the sixteen weeks of the fattening process. It is the average figures which are useful, as a general indication of what under like circumstances may be expected. The individual cases are apt to show fluctuations; hence the necessity of carrying out such experiments over a fairly large number.

The result over the twenty head is that they increased by 224 pounds each—from 1,064 pounds to 1,288 pounds live weight, or exactly two pounds per beast per day in 112 days, that is sixteen weeks, equivalent to an increase of 21.65 per cent. The biggest individual increase was 295 pounds and the lowest 182 pounds.

The details for the three feeding periods, based on the average of twenty head, are as shown below:—

Date.		Weight in pounds.	Tl. increase in pounds.	Daily increase in pounds.
<i>Period I.</i>				
May	3	1,064		
"	10	1,056.4		
"	17	1,059.2		
"	24	1,078.8		
"	31	1,088.5		
June	7	1,114		
"	14	1,134.6	70.6	1.175
<i>Period II.</i>				
June	21	1,119.6		
"	28	1,141.6		
July	5	1,120.4		
"	12	1,172.3		
"	19	1,159.5		
"	26	1,193.3	58.75	1.36
<i>Period III.</i>				
Aug.	2	1,223		
"	10	1,246		
"	16	1,277		
"	23	1,288	94.7	3.26
Total period, 112 days			224	2

During the first period the ration consisted of 13 pounds of veld hay, 4 pounds of ground-nut hay, 7 pounds of crushed maize and 18 pounds of majordas daily per 1,000 pounds of live weight. At the outset this was equivalent to the same ration per head, as the average weight was just a trifle over that figure. There was as usual a preliminary loss whilst the animals were settling down to their changed conditions, and whilst their more fluid grass-fed condition was being altered to the firmer flesh of a stall-fed animal. The rate of increase of weight for the first period was, however, below that of former years, and it would appear that the ration given was less nutritious than is necessary—in fact, had been too economically framed for the best results. As the gains in weight were below the ordinary, a higher diet was commenced a week earlier than usual—after six, instead of seven weeks—hence also the increase for the short period is less than would otherwise have accrued.

The daily ration in the second period was composed, per 1,000 pounds live weight, of 10 pounds of veld hay; 4 pounds of ground-nut hay, replaced after one week by 6 pounds and after four weeks by 10 pounds of velvet-bean hay; 4 pounds of maize stover throughout the period, which was not readily eaten and therefore not increased; 9 pounds of maize meal, increased after two weeks to 10 pounds; also 2½ pounds bean meal, 1 up to 2 pounds of sunflower meal and 1 up to 2 pounds of ground-nut meal; and of succulents, 12 to 22 pounds of silage and 8 up to 22 pounds of majordas.

In the average weights recorded certain fluctuations appear which have to be explained, and are instructive as indicating the extreme need for care and regularity in all that pertains to the feeding process. On 28th and 29th June the ration of oil-containing feed (sunflower and ground-nut) was raised suddenly instead of gradually, with the result that the cattle purged, seventeen out of the twenty head lost weight and all suffered a distinct set-back. In July, owing to drought, the well gave out, and water had to be carted from the river; the consequent change and irregularity in watering affected the animals, which became restless and went off their feed, and all but two lost weight instead of gaining steadily. These irregularities are reflected in the weekly average weights and in the fact that the gain for the second period was only $1\frac{1}{2}$ pounds daily instead of about 2 pounds. The second period lasted till 26th July, giving 42 days against a usual seven to eight weeks.

In the third period the prescribed ration was adhered to as closely as the taste of the cattle admitted, for, as they become fat, bullocks are fanciful, and their preferences have to be individually studied if the best results are to be obtained. The diet consisted of 6 to 8 pounds of veld hay, 6 to 8 pounds of velvet beans, 6 pounds of maize stover, 10 pounds and latterly 9 pounds of crushed maize, 2 pounds each of bean, sunflower and ground-nut meal, 10 to 16 pounds of silage and 12 to 16 pounds of majordas and pumpkins.

Seven animals completed their careers on 10th August; the rest were kept on till 23rd August. The average figures have been struck accordingly. During this last period, when a forcing diet was resorted to to finish them off, the average gain was much more rapid, making up fully for earlier tardiness and set-backs, the animals being in a condition to benefit to the utmost by the high feeding.

The food consumed to attain these results amounted in all to—

	Ttl. in pounds.	Pounds per head.
Veld hay	28,454	1,422.7
Velvet-bean hay	7,750	387.5
Ground-nut hay	7,623	381.2
Maize fodder	7,857	392.9
Silage	19,696	984.8
Majordas	33,598	1,679.9
Maize (crushed)	23,158	1,157.9
Bean meal	3,379	169
Ground-nut meal	2,994	149.7
Sunflower meal	2,994	149.7

The profit in any particular year varies according to the values placed on the saleable food, such as maize, beans, etc., and occasionally hay, and the price of beef. This year notoriously maize has been up and beef down, and financially the results are poor. In a season when grain is normal or cheap and when cattle come back to fair prices the fattening of cattle should be a profitable business, more especially when the conversion of fodder crops into marketable forms and the

production of about 4 tons of manure per head are taken into consideration.

Difficulty was found, it was interesting to note, in inducing the stock accustomed to ground-nut hay to eat instead velvet-bean hay, although after a few days they learned to take it. Perhaps it would be better to use velvet-bean hay first, and keep the other for the later stages.

Somewhat better results might have been obtained but for the accidental circumstances indicated above, but such are bound to occur in ordinary farming experience and have to be reckoned with. The period of feeding was somewhat curtailed, and it would be well to allow for eighteen weeks instead of sixteen, though this again must vary with the season, the feed available, the class of cattle and their condition at the outset of feeding.

The second lot, for comparison with those dealt with above, may now be considered. Brought down from Inyanga at the same time, they were from precisely the same herd and presented no difference from the first twenty, ranging from 1,095 down to 835 pounds in weight, with an average of 967.5 pounds.

These cattle were to be grazed, with additional feeding, in the hope that by the time the first lot were finished they would have reached a stage corresponding to the end of the first period of stall feeding. Though well treated and given all they would eat, they did not attain this improvement—in fact, they did not remain stationary, though the loss was insignificant and was probably counterbalanced in their preparedness to fatten when placed in the stalls. These bullocks received good natural grazing such as the farm affords from 3rd May till 27th June, when, the veld beginning to fail, this was augmented with silage, majordas and maize stalks. From 8th August they were changed to another paddock, where they received hay, silage and majordas. In addition to grazing, therefore, they received during this period about 30,000 pounds of silage, 30,000 pounds of majordas, 20,000 pounds of maize stalks and 10,000 pounds of hay.

The average weight during this period, instead of a gain, shows a small loss of 3.55 pounds, the total for the twenty head being 19,284 pounds, as against 19,355 pounds originally. Actually twelve head lost weight and eight gained, the difference over the twenty head being only 71 pounds, and in seven cases the difference was under 7 pounds each or virtually stationary. Probably, if concentrates had been fed, a gain would have been recorded.

The result for these twenty head over the stall-feeding period only shows an average increase from 967.75 pounds each to 1,166.3 pounds in 96 days, that is by 198.5 pounds, or 2.07 pounds daily, for say 14½ weeks, or rather less time than in the previous instance.

The particulars are as follows, on averages:—

Date. 1922.	Weight in pounds.	Ttl. increase in pounds.	Daily increase in pounds.
<i>Preliminary period.</i>			
May 3	967.75		
Aug. 22	964.2	—3.55	nil
<i>Period I. (stalled).</i>			
Aug. 28	971.25		
Sept. 4	971.4		
„ 11	998.7		
„ 18	1,002.25		
„ 25	1,011.15	4.7	1.4
<i>Period II.</i>			
Oct. 2	1,075.4		
„ 9	1,086		
„ 16	1,119		
„ 23	1,117.6		
„ 30	1,126.95		
Nov. 6	1,137.35	12.6	3.1
<i>Period III.</i>			
Nov. 13	1,151.3		
„ 20	1,154.1		
„ 27	1,166.3	29	1.4
Total period, 96 days		202	2.07

These twenty head of cattle were stalled on a ration of 14 pounds of veld hay, 4 pounds of velvet-bean hay, 18 pounds of majordas and 6 pounds of maize per 1,000 pounds live weight. This period lasted only 34 days, and the average daily rate of increase of these partially fed animals is noticeably better than in the case where they were stalled direct from the ranch.

The second period lasted 41 days, and showed a daily average gain of 2.7 pounds, a very high figure, due to the high feeding given. The ration during this stage consisted of 10 pounds of veld hay, 6 up to 10 pounds of velvet-bean hay, 10 pounds of mangels, 9 and latterly 10 pounds of crushed maize, 3 up to 6½ pounds of bean-pod meal and 2 to 3 pounds of sunflower meal. The maize and beans and velvet-bean hay were somewhat liberally fed, but undoubtedly the gain was correspondingly rapid.

Five bullocks were so prime that they were now sold, and the rest were also virtually finished, as is shown by the fact that the daily average increase for the last three weeks fell to 1.4 pounds again, although the ration consisted of 8 pounds of veld hay, 10 pounds of velvet-bean hay, 8 pounds of majordas, 10 pounds of maize meal, 6½ pounds of bean-pod meal and 3 pounds of crushed sunflower.

The food consumed by these cattle from the time they were stalled amounted to:—

	Ttl. in pounds.	Pounds per head.
Veld hay	25,289	1,264.4
Velvet-bean hay	19,005	950
Majordas	20,908	1,045.4
Mangels	7,910	395.5
Maize (crushed)	21,692	1,084.6
Bean-pod meal	8,987	449.4
Sunflower meal	4,479	224

A subsidiary experiment was introduced in that the bullocks in one pen were given an additional daily ration of 3 ounces each, amounting in all to 55 pounds, of bone meal. It has been claimed elsewhere that notable benefits resulted from this treatment, but it cannot be said in these experiments that any marked difference was observed.

During the course of these experiments certain points—details perhaps, but none the less important—have come to notice, and next season it is proposed to put the following questions to the test so far as circumstances permit:—

- (1) comparisons of grades of different breeds of cattle fed on the same lines as in past years;
- (2) sweet potatoes *versus* maize;
- (3) sunflower *versus* ground nut;
- (4) bean meal *versus* bean winnowings.

Throughout these experiments the cattle and all details of their care, and the tabulation of weights of the animals and of the food supplied to them, have been in the charge of Mr. Donald Black, to whom acknowledgment is therefore due.

Cattle Fattening Experiment No. 12.

SHORTHORN GRADES *VERSUS* SUSSEX GRADES.

Simultaneously with the stalling of the Shorthorn cattle used in the second series of experiment No. 11, and therefore comparable to them, a similar lot of Sussex oxen were put up for fattening and treated in every way identically with them. Kindly provided by Mr. L. Glanfield, of Ballineety, Mazoe, the well-known breeder of Sussex

cattle, they were selected as likely feeders from a herd of high-grade Sussex oxen which had been receiving much the same previous handling as had the Shorthorn grades. Their initial live weights were less, viz.: 968, 898, 893, 889, 880, 793 and 735 pounds. They were penned at the same time and received in every respect identical treatment. The increase for the seven Sussex grades, when reduced to averages, works out at practically the same rate as for the twenty Shorthorn grades. The live weight was on the average one hundred pounds less. They were considered prime at the end of the second period, and five were accordingly then sold three days later.

Tabulated as before, the results are given below:—

Date. 1922.	Weight in pounds.	Ttl. increase in pounds.	Daily increase in pounds.
<i>Period I.</i>			
Aug. 28	865.2		
Sept. 4	857		
„ 11	912.3		
„ 18	901		
„ 25	909.1	44	1.4
<i>Period II.</i>			
Oct. 2	983		
„ 9	976.3		
„ 16	1,021		
„ 23	1,011.7		
„ 30	1,053.5		
Nov. 6	1,031	122	3

The two lightest were kept on till the middle of November, but did not make additional weight, confirming the impression that they were then finished.

Slight fluctuations in the weights such as appear here have been experienced in all our cattle-feeding experiments, and are due to the chances of eating and watering and voiding by the stock just prior to weighing, which are much greater when individual figures or small numbers are taken than when the average over larger numbers is considered. It is the general figures which are of interest, and these come out in this instance most extraordinarily alike for the grades of the two breeds.

Sold by private treaty, the price obtained per 100 pounds was the same for Shorthorns and Sussex.

Composition and Fertilising Value of Wood Ash and other Ashes.

By G. N. BLACKSHAW, O.B.E., B.Sc., F.I.C., Chief Chemist,
Department of Agriculture.

During the war, when the supply of reliable commercial fertilisers was almost non-existent and such fertilisers as could be obtained were offered at prohibitive prices, attention was directed to the large dumps of wood ash which had accumulated at local mines, and in consequence the value of wood ash as a fertiliser has of late years become more appreciated by local agriculturists.

Wood ash owes its value in agriculture to the lime, potash and phosphoric oxide which it contains, the amounts of these constituents present being subject to considerable variation. Not only do the ashes from different varieties of wood vary in composition, but from the same tree the ash yielded by the twigs and bark possesses a lower agricultural value than that obtained from the older wood. Furthermore, as almost all the potash is soluble in water and is liable to be leached out if the ash is exposed to rains, it will be readily understood that the fertilising value of wood ash depends upon three factors, viz., the variety and age of the wood used and the conditions under which it has been stored.

The compositions of samples of Rhodesian wood ash which have been analysed at the Agricultural Laboratory, Salisbury, are set forth in the following table:—

Sample Lab. No.	Lime (CaO).	Phosphoric Oxide (P ₂ O ₅).	Potash (K ₂ O).
	Per cent.	Per cent.	Per cent.
15	49.33	0.88	0.95
105	18.37	4.72	1.10
3182	...	4.34	1.10
24	22.04	3.15	2.27
21	34.66	4.42	5.22
22	33.20	4.72	5.07
23	22.84	2.33	4.03
51	44.64	4.25	2.42
52	48.00	4.43	2.12
53	38.68	5.41	3.19
170G	38.02	3.73	1.69
250G	39.76	5.56	2.50
282G	39.40	1.77	4.75
347G	25.1	2.49	1.44
348G	34.4	2.34	5.02
613G	47.32	1.34	0.41
Range of variation	{ 18.37 49.33	0.88 5.56	0.41 5.22

Regarding the history of the samples, the only authentic information was supplied in reference to samples Nos. 347G and 348G; No. 347G being obtained from a dump which had been exposed to the weather for 15 months, whilst 348G was new unleached wood ash produced chiefly from native timber m'sassa, with a little m'hobohobo; owing to leaching, the smaller amount of potash in the ash which had been exposed is to be noted. The variability in composition of wood ash will be realised on noting the range of variation in the percentage amounts of lime, potash and phosphoric oxide present in the samples examined. Although subject to loss in fertilising value if exposed to rains, some samples which were taken from old dumps that had doubtless been exposed to the weather for several years contained very fair quantities of potash as well as phosphoric oxide, the loss by leaching having been reduced owing to the immense size of the heaps.

Among the observant farmers, there have been some who have acquired the right to make use of the wood ash produced at the mines in their vicinity, and who have been able to give their lands liberal dressings of the ash at comparatively little cost, the usual rate of application ranging from $\frac{1}{2}$ to 2 tons per acre. To Mr. Basil Christian, Ewanrigg, Arcturus, we are indebted for a very useful report of his observations concerning the use of wood ash in conjunction with green manuring, which was published in the August, 1921, issue of this Journal.

Mr. Christian's experience has been that the use of wood ash in conjunction with a leguminous crop such as velvet beans is one of the cheapest and most rapid methods of getting land into good heart,

if the wood ash can be landed on the farm at a reasonable price. The application of wood ash in conjunction with a green manuring crop not only provides lime to sweeten the soil and promote the decomposition of the vegetable matter turned under, but also enriches the soil in phosphoric oxide and potash. Mr. Christian has found that on good red land dressings of $\frac{3}{4}$ to 2 tons of wood ash per acre supplied to a crop of velvet beans, either reaped or ploughed under, effect a very marked improvement in the succeeding maize crop, and that the improvement lasts for five years at least, the improvement being greater than that observed on similar land which had been green-manured with velvet beans, but which had not received a dressing of wood ash. On poor land similarly treated and the velvet beans ploughed under, a wonderful improvement in the returns of succeeding crops is effected.

In order to ensure an even distribution of wood ash, it is a common practice to put the ash into sacks and place the sacks at even distances apart over the land, so that the area to be covered by a sack of the ash is defined. The weight of a sack of wood ash varying according to the amount of moisture in the ash, it is advisable, if this method of application is adopted, to weigh one filled sack in order to ascertain the number of filled sacks required per acre. The weight of a grain sack filled with ash that has never been exposed to rain is about 110 lbs.

Sunflower Ash.—A sample of sunflower ash derived from burnt stalks, leaves and heads after removal of seeds was found on analysis to contain potash 20.9 per cent., phosphoric oxide 0.98 per cent., and lime 12 per cent.

The sunflower crop takes so much mineral plant food out of the land that it would be sound practice to collect and burn the stalks, etc., and return the ash to the land on which the crop was grown. Although the exhausting nature of the sunflower crop has not so far been manifested in the succeeding maize crop, yet there is a danger that the fertility of a soil on which sunflowers are grown frequently will fall rapidly unless the land receives liberal manurial treatment.

A mixture of bone dust and sunflower ash in the proportion of two parts by weight of bone dust to one part of sunflower ash would answer very well for potatoes, if applied at the rate of 200 to 300 lbs. per acre in conjunction with kraal manure.

Ash from Maize Cobs.—The ash of maize cobs is particularly rich in potash, but the amount of ash which can be obtained from the cobs produced per acre is very small, as will be seen from the following particulars. From weighings in maize manurial trials at the Salisbury Experiment Station, it has been found that the crop produced grain to cob (core) in the proportion of 2000 to 344—in other words, a crop yielding 10 bags of grain per acre would produce 344 lbs. of cobs from the same area. The average amount of ash contained in two samples of cobs analysed at the Agricultural Laboratory was 0.98 per cent., and the average amounts of potash and phosphoric oxide in the ashes of three samples were 36.3 per cent. and 4.6 per cent. respectively.

Thus, the ash obtainable per acre from the cobs of a crop yielding 10 bags of grain per acre would be about $3\frac{1}{2}$ lbs., containing about $1\frac{1}{4}$ lbs. of potash and less than $\frac{1}{4}$ lb. of phosphoric oxide.

This yield is so very small that accumulations of maize cobs can be used more advantageously locally for fuel or for the manufacture of charcoal for pigs and poultry, or thrown into the kraal and made into manure. Any "maize cob" ash available can, with advantage, be mixed with bone dust in the proportion of four parts bone dust to one part of cob ash, and the mixture used either for potatoes at the rate of 200 to 300 lbs. per acre in conjunction with kraal manure or in the vegetable garden at the rate of 2 ozs. per square yard. Probably other and more profitable uses for this by-product of the maize industry will be developed.

"Leaf Mould" Ash.—A sample of "leaf mould" ash analysed at the Agricultural Laboratory contained lime 9.68 per cent., potash 0.41 per cent., and phosphoric oxide 0.75 per cent. The small quantity of material of this nature available can be usefully dug into garden soil at the rate of 1 to 2 lbs. per square yard, but it would be much better, as a rule, to dig the unburnt leaf mould into the soil.

Peat Ash.—A sample of peat ash taken from a heap which had been obtained by burning reeds, grass roots, leaves, etc., and had been exposed to the weather for about five years, was found on analysis to contain lime 4.39 per cent., phosphoric oxide 0.22 per cent., and potash 0.24 per cent. The deduction drawn from the results of analysis of the sample is that the rate of application per acre of such ash should be about ten or twelve times that of wood ash, if it is to be used as a substitute for the latter.

"Veld Hay" Ash.—A sample consisting chiefly of the residue from the accidental burning of veld hay was found on analysis to contain lime 2.68 per cent., phosphoric oxide 0.85 per cent., and potash 0.86 per cent. The use of any small quantity of this material there may be available on the farm in conjunction with kraal manure on tobacco or potato land should give very good results; the kraal manure being applied broadcast and ploughed in at the rate of about 25 Scotch cart loads per acre, and the ash broadcasted on the ploughed land at the rate of about 3 tons per acre and well harrowed in. For farm crops in general, an application of the ash at the rate of 3 tons per acre would improve the crop returns.

The Cattle Industry.

The present markets for slaughter cattle from Southern Rhodesia are very restricted. To the Congo we can only send cattle during the latter six months of each year owing to restrictions imposed on the in-transit trade by Northern Rhodesia. That market is at the best a very limited one at present, though it may, we hope, grow. During the period it was open (four-and-a-half months) in 1922 only 2,767 cattle went to the Congo. The market to the south is not likely to increase, rather the reverse, and the steps being taken by certain farmers' associations in the south, whether successful or not, indicate a feeling which is not to be overlooked. Natives, owing to the recent famine, have been obliged to sell their cattle, thus glutting the market with inferior stock.

In the face of these adverse conditions the season has of late been excellent, and so far as the stock is concerned enables men to hold, but on the other hand only assists breeding and fattening, and increases our steadily accumulating surplus. Our naturally favourable conditions for stock only accentuate our prospective dilemma, and emphasise the need of early action to find outlets for our cattle. To this end the Committee appointed by the Government to examine the condition of the cattle industry is exploring the question in every direction, and an early report is impatiently awaited. As soon as this report is available it is hoped that Government will consider it, and move in the matter, for it is action, not talk, that is needed.

Under the auspices of the Cattle Owners' Association a representative of the Bullock Meat Preservation Company has arrived in Bulawayo from Australia, bringing with him further samples of meat, which arrived in good condition, and also proposals for the disposal of the local patent rights in this country. Negotiations are, we understand, proceeding, careful consideration being given to all aspects of the subject by those disposed to take it up, but owing to contradictory accounts from Australia and the need of careful consideration of the subject from every point of view, it may be some time before any decision can be reached. The efficiency of the system seems to be established, but even so, the value of such a preservative process to us has to be considered; and further, there is some doubt as to the approval of the medical authorities in Australia regarding the effect of the preservative ingredients on the ultimate consumer. Removal of these uncertainties seems desirable before practical developments can take place.

The Meat Producers' Exchange, though too remote from the greater part of Rhodesian cattle raisers to be of much direct use to them, has no doubt greatly benefited general marketing conditions

throughout South Africa, which, but for its existence, would probably have been much worse even than they are.

Certain extracts from the published reports of recent meetings deserve the special attention of Rhodesian farmers. Speaking at the annual meeting held in Johannesburg on 7th September, Mr. Gwynn said:—"As stock owners you are all no doubt aware of the present deplorable state of the live stock industry, and appreciate that this condition is primarily due to the fact that South Africa is at last producing many more slaughter oxen and pigs, and perhaps more slaughter sheep, than can be consumed in this country." This is a matter of congratulation to Government and stock owners, showing that the country has largely recovered from the devastating diseases which at one time threatened the live stock industry. It also proves, if such proof were needed, that in South Africa there are huge areas ideally adapted to the production of live stock. While the production beyond the local needs is a matter for congratulation, it is the accumulation of the surplus in the country which threatens to prove fatal to the industry. It is not over-production, but under-export. It is no doubt apparent to everyone that under conditions where five oxen are offered for sale and only four are required by the trade, buyers have, as is to be expected, taken advantage of this over-supply and put one seller in competition with another and caused a fall in slaughter stock values.

"Although the fall in average prices has been very material, there is one striking exception which should carry a lesson to all stock owners, *i.e.*, that prime cattle, that is to say, cattle which have been well bred and well cared for, have fallen very little in price. Cattle of all grades less than prime have fallen most in value; indeed the least good are to-day practically unsaleable except through the Exchange.

"Low as prices are, it is at least some consolation to know that the slump here has not been so complete as that in Australia, Brazil and other parts of South America, where the same export problem has to be dealt with. It is a matter of general knowledge that in Australia, in spite of the Government bounty of $\frac{1}{4}$ d. per lb. on beef exported, owners of prime 600 lb. slaughter oxen (cattle suitable for that trade) are receiving little more than £5 per head; while in Brazil and other export countries in South America cattle for which we are still returning to our members from £6 to £7 can be bought at £2 per head, and even less. So far as we can see from trade conditions, there is no reason why prices should not be on much the same level in South Africa as in South America and Australia. It is our considered opinion that this complete collapse has been prevented by the operations of the Exchange.

"The Exchange, as you know, is a slaughter stock marketing agency. Its operations are carried out on behalf of its members, who, in addition to their shareholder interest, are under a definite written contract to market slaughter stock through the Exchange only.

"Beyond the earning of its commission and recovering from its

members the costs and expenses incurred in its marketing operations, the Exchange has no commercial interest in the stock marketed. Its operations, therefore, are as nearly as possible purely disinterested. Although it is a limited liability company, its shareholders are producers, and the interest of the Exchange is primarily the interest of its members and those of the live stock industry as a whole. The success of the Exchange is not to be measured by profits earned, but rather by the effect of its operations on the live stock industry. If members and others would bear in mind always this difference between the Exchange and all other marketing agents, much of the criticism which has been levelled against our movement by trade opposition and others would be ignored. We are, in effect, a co-operative combination of stock owners seeking the most direct means of selling and distributing our products to the consumer."

At an adjourned meeting on 1st December, the Chairman, Mr. Walter Hudson, said:—"There is another matter that I think the members should pay some very serious attention to, and that is the surplus cattle that we have in the Union and the adjoining territories to-day. The number now is very considerable, and it goes on increasing year after year, and in time will become a very serious menace. We will never be able to stabilise the local prices until you have got rid of your surplus production, and it would seem that the only way in which the surplus production can be got rid of is by means of export."

The export of live cattle from South Africa has of late been much discussed in view of the admission of store stock from Canada to Great Britain to be fed there. Atlantic cattle boats are not ocean greyhounds, and the voyage from Capetown, Luderitzbucht or Walvis is not much (if any) longer. Live cattle are now permitted to be sent from the United States to Duisburg and Meiderich in Germany for slaughter; also from Madagascar to Mauritius and Reunion. Till very recently at least breeding stock has gone in large numbers from India to Brazil, perhaps the longest voyage of any. These are distinct from the ocean transport of stud stock, where extra care is provided.

It would seem reasonable to suppose that a preference would be shown for beef instead of horse flesh amongst civilised consumers, yet recent official statistics show that there is a considerable export of horse carcasses going on from England to France, Holland and Belgium, a trade in meat which has replaced the traffic in decrepit horses which previously existed, and to which much exception on humanitarian grounds was taken. Surely one would think, at present prices in countries of its production, like Australia, South Africa and South America, beef could be supplied as cheaply as horse flesh, and would be purchased in preference, yet the continental market takes yearly between ten and twelve million pounds weight of horse meat from the British Isles. In this connection it is well to recollect that in the Argentine Republic, with all its great wealth of cattle at hand, there are shops openly retailing horse meat. Yet we could wish that we were in a position to compete with good young beef off the veld against worn out "gee-gees."

Farm Cheese-making.

(Conclusion.)

By T. HAMILTON, M.A., N.D.A., N.D.D., Dairy Expert.

Coagulation and Cutting the Curd.—Under ordinary circumstances coagulation should be complete in about 35 minutes, and this should be tested by inserting the finger just under the surface of the coagulum. If the curd breaks cleanly over the finger or comes away from the side of the vat when pressed with the flat hand, the curd is ready for cutting.

In the absence of American vertical and horizontal curd knives, long table knives tied together as shown in the illustration answer the purpose fairly well, although they must be most carefully used to get an even cut. Cut lengthwise and crosswise, and then gently stir the curd from the bottom, and continue cutting until the pieces of curd on an average are about the size of half-inch cubes. Cutting must at all times be done as evenly as possible, and the pieces of curd must not be bruised or injured in any way. When properly cut, the particles should be uniform in size and the whey which rises should be of a pale greenish colour. If a white whey should result after cutting, a good deal of valuable material is lost, and the cheese will be reduced in weight and the quality will be impaired.

Scalding the Curd.—After gently stirring with the hand for 5 minutes, the temperature should be raised gradually by pouring hot water into the jacket of the vat. The raising of the temperature to the maximum scald takes about 45 minutes, the first 30 minutes of which should be occupied in raising the temperature to 90 degrees. After this degree has been reached, the temperature can be raised more rapidly until the maximum temperature of 98 to 100 degrees is reached. The maximum temperature of scald varies according to the quality of the milk; the lower the butter-fat content of the milk, the lower the temperature of scald, and *vice versa*. Stirring should continue throughout the process, and care should be taken to ensure an even scald for every particle of the curd by keeping the small portions constantly moving. When the curd becomes of a rubbery nature, the proper degree of firmness may be determined by pressing a mass of it between the hands. If when suddenly freed from pressure the pieces fall apart at once and show no tendency to stick together, the curd is of the proper firmness. At this stage the small particles of curd have contracted to less than one half the size they were when the curd was cut.

If the curd becomes too firm, the cheese will be dry and "corky"; whilst, if the curd is not firm enough, the cheese will be soft, and under average summer temperatures will be apt to become sour.

Testing for Acidity and Running the Whey.—This is the most important point in the process of cheese-making. Premature action with regard to taking off the whey often results in a slow cheddaring curd, and one which is likely to produce gas and a bad flavour during the ripening process. On the other hand, if the whey is left too long, too much acid will be produced and a dry mealy cheese will result.

Various tests for ascertaining the acidity of milk have been devised, but the hot-iron test is the simplest and most inexpensive one at the command of the cheese-maker. For this test a smooth flat bar of iron about 1 inch wide and $\frac{1}{4}$ inch thick is heated to such a degree that, when a piece of curd is taken from the vat and well consolidated in the palm of the hand, it just browns and does not blacken. If acidity has been developed, small hair-like threads will extend from the curd to the hot iron. The length and fineness of these threads determine the degree of acidity. When the thread is from $\frac{1}{4}$ to $\frac{3}{8}$ inch long the whey can be removed. On the farm this can be done by ladling off the whey or by running it off with a syphon.

Cheddaring the Curd.—When all the whey, as far as possible, has been removed, the curd, after being cut into squares, should be tied up in a cloth and kept warm. The cloth should be opened up every 20 minutes and the curd cut up and re-tied. The cheddaring process should be completed in about 30 to 40 minutes. This will be indicated by the curd tearing in long fibres like the breast of a chicken, or by drawing threads of from 1 to $1\frac{1}{2}$ inches when tested on the hot iron.

Breaking up the Curd.—The curd is now cut or broken into small pieces for salting. It should be well stirred and aerated before salt is applied.

Salting the Curd.—Salt is added at the rate of 1 ounce to every 3 gallons of milk used for cheese-making. It must be well stirred in and the curd piled so as to allow the salt to dissolve.

Putting the Curd into the Mould.—The type of mould recommended is in general use throughout South Africa. It is strong and practically indestructible, and with ordinary care will last for a lifetime. The illustration shows the various parts, which consist of two lids, a flexible steel lining and a solid collar. The flexible steel lining fits into the smaller of the two lids and is lined with tubular cheese bandage, a portion of which overlaps. This part of the mould is filled with curd, which should be well pressed down with the fist. When this portion of the mould is filled, the solid collar is placed on, the hooks providing the support. The collar is then filled, the curd being well pressed in, a muslin top is put on, and the lid put on over all, the hooks removed, and the cheese placed in the press.

The Cheese Press.—The type of cheese recommended requires a good deal of pressure, and it is difficult to get as much as is required without

some sort of screw press. For this nothing is better than a wagon jack fitted into a frame. As much as two tons pressure can be applied if the frame is strong enough. For small cheeses, however, 15 cwt. is enough. The screw of course should be tightened periodically. Pressure should be applied until the following morning.

"Dressing" and Bathing the Cheese.—The cheese on the following morning should be taken out of the mould. The bandage should be pulled up and all wrinkles smoothed out. If necessary a portion of the overlap can be trimmed off with the scissors, a neat finish being of great importance. When trimmed up, the cheese should be lowered into hot water at a temperature of 140 degrees for one minute. Take the cheese out of the water and wash the various portions of the mould, then place the cheese back in the mould. Replace the mould in the press, and put on full pressure for another 24 hours.

Curing the Cheese.—It is very little use going to the trouble to make cheese if it is to be spoiled in the curing. A high temperature is fatal to good results being obtained. The cheese either blows or the fat runs out, leaving nothing else but hard dry casein. It is therefore essential that a building be erected which can be almost hermetically sealed during the day and thrown open at night. A good brick thatched rondavel with a glazed window and a double door forms a good cheese store-room. The provision of a ceiling, however, is advisable, and the structure should be made rat-proof by means of small meshed wire. Shelves which are easily movable should be provided, and the interior of the building given a coat of whitewash.

The cheese should be turned every day. Sometimes in damp weather green mould may appear. Although this sometimes looks unsightly, it is easily removable when the bandage, pressed on to the cheese, is torn off. If the cheese is properly made and properly pressed, the mould will not penetrate and will do no appreciable harm. Great care should be taken to keep flies out of the curing room.

The Cheese Mite.—There have been numerous complaints during the past season of the activities of what is generally known as the cheese mite. This mite is probably carried by flies, since it appears in parts of the country where cheese has never hitherto been made. If the flies are excluded and the room kept dark, these organisms, whatever their origin, do not seem to be able to gain admittance. The mite has the power of increasing at a rate which is only equalled by that of the aphid. If it gains a hold on the cheese, in a short time the whole of the interior of the cheese becomes one living mass of almost transparent organisms. The cheese breaks down into a mass of fine dust. When one cheese is attacked the mites quickly spread, and may in extreme cases totally destroy or render unsaleable the whole season's output.

If it is noticed that the mites have just appeared, they may be checked by immersing the cheese for a few seconds in boiling water. In most cases, however, the trouble has become so deep seated that even this drastic treatment is ineffective, and nothing can be done but isolate the affected cheese and keep a strict watch on the remainder. Preven-

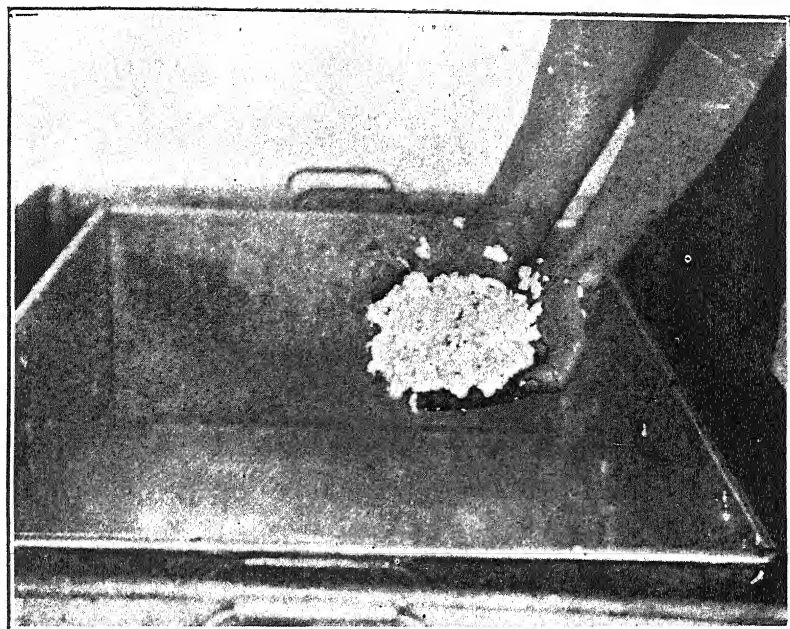


Fig. V.—Showing appearance of curd when scalding or cooking process is complete.

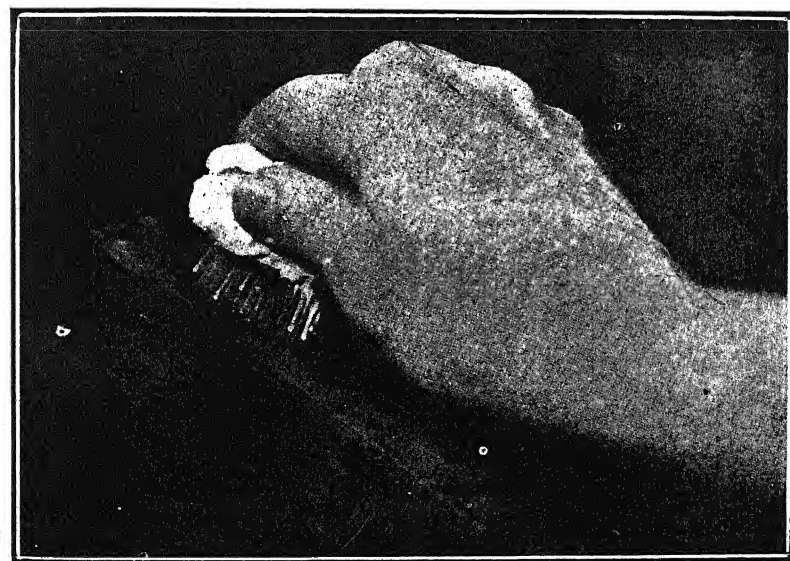


Fig. VI.—The hot iron test. When silky threads about $1\frac{1}{4}$ inches in length are obtained, the curd is ready for cutting up and salting.

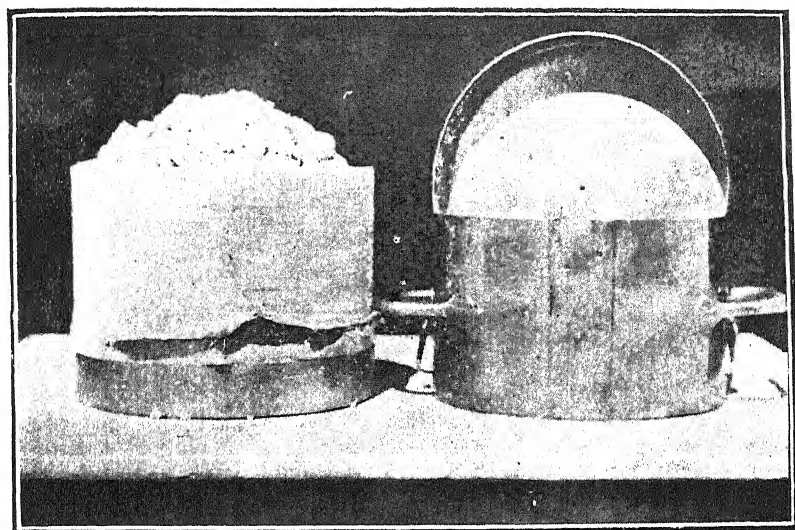


Fig. VII.—Showing how the mould is lined with cheese bandage. When the lower portion is full, the solid collar is put in position and the remainder of the curd filled in.

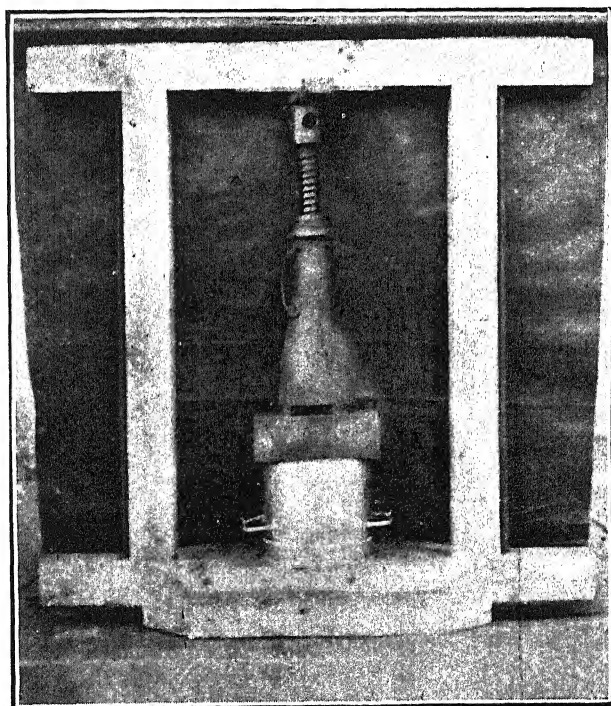


Fig. VIII.—An effective cheese press made with the help of a wagon jack.

tion is of course better than cure, and if the cheese-curing room is rendered fly-proof and kept dark, no trouble on the score of the cheese mite need be anticipated.

SUMMARY.

Prepare a starter by heating, in a double pan, a pint or more of separated milk to a temperature of 180 degrees. Keep at this temperature for 20 minutes. Cool down the milk as rapidly as possible, and keep the vessel containing it in cold water for two days in a cool place. The milk should then be thick and quite smooth in appearance.

Adding the Starter.—Break up the thick milk and strain 1 pint of “starter” into 8 to 10 gallons new milk. Allow the milk to stand, covered over with a sheet, at a temperature of 86 degrees for $\frac{1}{2}$ to 1 hour.

Colour.—Add cheese colour at the rate of 1 teaspoonful (mixed with water) to 10 gallons milk.

Rennet.—Add cheese rennet in the proportion of 1 teaspoonful rennet (mixed with a cup of water) to $2\frac{1}{2}$ gallons milk. Stir for 2 minutes.

Cutting.—Cut the curd with table knives tied together when it splits cleanly over the finger. Cut until the pieces are about the size of the thumb nail.

Heating.—After stirring for 5 minutes, raise the temperature, gradually stirring all the time, 1 degree every 5 minutes, until 90 degrees is reached. Raise the temperature more rapidly up to from 96 to 100 degrees, according to the season of the year. Stir for 10 minutes after the maximum temperature is reached. The total time of stirring is from 50 to 55 minutes.

Taking off the Whey.—Allow the curd to settle. In about 20 minutes’ time take a piece of curd, press it in the palm of the hand for about a minute, dry it on a cloth and apply it to an iron just hot enough to brown the curd and not to char it. The threads should be from $\frac{1}{4}$ to $\frac{3}{8}$ inch long. Ladle off the whey when the threads are this length, and tie the curd up in a cloth. Place a weight on the cloth in which the curd is tied.

Cheddaring the Curd.—Keep the curd warm by means of covering it with a blanket. In 20 minutes open up the cloth and cut the curd into pieces about 5 inches square. Re-tie the cloth and leave the curd (covered with a blanket) for another 20 minutes. Test a piece of the curd on the hot iron. The threads should now be about $\frac{3}{4}$ to 1 inch long, and the curd should tear in a fibrous manner like the meat on the breast of a chicken.

Milling or Cutting the Curd.—Cut the curd into small pieces. Stir thoroughly to allow the gas to escape.

Salt.—Salt should be added in the proportion of 1 oz. to 3 lbs. of curd, and well stirred in.

Putting the Curd into the Mould.—The mould must be lined with thin calico or cheese bandage and the curd well pressed in with the hand. A wooden follower may be used with a home-made mould, but

it is recommended that an Australian pattern telescopic mould should be obtained. When full, the mould should be placed under slight pressure for half an hour. Heavier pressure such as is obtained by means of a wagon jack should then be applied and maintained for 24 hours. Next morning bathe the cheese in water at 140 degrees for $\frac{3}{4}$ minute and return to press. After pressing is complete a new bandage may be pasted on if necessary, but with the telescopic mould only one bandage is used and that is pressed on to the cheese.

Curing.—The cheese is usually ready for sale in about five weeks if kept at a temperature of 70 degrees. It should be turned every day on the shelf. The curing-room must be made fly-proof.

Southern Rhodesia Egg-Laying Test.

Entries are invited for the fourth annual egg-laying test of Rhodesia. The contest will extend from 1st April, 1923, to 2nd March, 1924, inclusive.

Entries must be submitted not later than 14th February, 1923.

Full particulars and entry forms can be obtained on application to the Poultry Expert, Department of Agriculture, Salisbury.

Insect Pests of Fruits other than Citrus in Southern Rhodesia.

(Continued.)

By RUPERT W. JACK, F.E.S., Chief Entomologist.

INSECTS WHICH EAT THE FRUIT.

Under this heading we have a number of beetles of different species, by far the most important of which is the Common Fruit Beetle (*Pachnoda impressa*, Gold). An account of the life history of this insect appeared in the *Rhodesia Agricultural Journal* as recently as February, 1921. This beetle is about 1 inch in length, dark green on the back, conspicuously bordered with yellow. It has a close relative (*Pachnoda rufa*, De Geer) which is often common and has apparently similar breeding habits. This species may be termed the Russet Fruit Beetle, and looks much like a faded edition of its more gaily coloured relative, the back being greenish-russet, fading to drab at the sides. The head is of a rich green colour, with two conspicuous white stripes, and the under parts are of a similar green marked with white.

Numerous other beetles of the same sub-family, the *Cetoniides*, are to be found feeding on fruit, but they need not be dealt with in detail. In point of fact, with the exception of *Diptognatha silicea*, Macleay, which has on several occasions been bred from its larvæ found in rotting thatch, practically nothing definite is known concerning the breeding habits of our other local *Cetoniids*. In general they are supposed to feed in the larval stage on decaying vegetable matter of different sorts.

This is in any case the habit of *P. impressa* and *P. rufa*. The eggs are laid from December to March in rotting cattle dung, and in accumulations of humus generally, as for instance in the soil under old wood piles. They are generally found about an inch or so from the surface. They are white, and when newly laid measure about one-thirteenth of an inch in length. As is general in this family of beetles, the eggs increase in size during incubation and become nearly spherical in shape. They take from 15 to 18 days to hatch.

The grubs grow rapidly, those from the first laid eggs becoming full fed by June, whilst most are full fed by September. The full fed larva constructs a neat earthen cell in the soil (see fig.), and rests in

this for a varying period before pupating. At Salisbury pupation appears mostly to take place in late September and early October, the adult beetles appearing from about the middle of November, but this depends somewhat upon the rains.

The adults of *P. impressa* feed upon blossoms, foliage and fruit, the favourite foliage appearing to be that of the grape vine, whilst the favourite fruits are apparently peaches and plums. Apples and other fruits are, however, attacked. Blossoms of various sorts are eaten, including both native and cultivated plants.

Control.—Owing to the comparatively large size of these insects, they can readily be seen at work and steps taken to deal with them. A net with a loop about 18 inches in diameter mounted on a five-foot pole is recommended by Mr. D. Gumm, of the Division of Entomology in the South African Union. The net is easily made of stout wire and cheese cloth. This is held under the beetles, which when disturbed drop into it. From the net they are tipped out into a paraffin tin containing a little water with a film of paraffin oil on the surface. This kills them instantly.

It may be mentioned that early morning and evening are the best times to collect the beetles, as they fly readily during the heat of the day, and at this time an accidental jarring of the tree may set all the beetles buzzing round, when they are not so easily collected.

It is claimed that consistent attention may result in saving practically the entire crop, and, as the work can readily be performed by a native of average intelligence, the fruit should be saved from the insects at small cost.

Trees correctly netted against fruit-piercing moths, etc., are of course also protected from fruit beetles.

INSECTS WHICH ATTACK THE FOLIAGE.

1. **Aphides.**—Two species of aphides are known as pests of peach trees in South Africa, but so far only one has been recorded as definitely attacking this tree in Southern Rhodesia. This is the Black Peach Aphis (*Aphis persica*, Boyer), and complaints of injury even by this species are very infrequent. The Green Peach Aphis (*Rhopalosiphon dianthi*, Schrank), although common enough in the Territory on cabbage and allied plants, has not yet been found on peach, even on trees growing close to infested cabbages. This is not to say, however, that it may not attack peach in certain localities.

Available information concerning the life history of the Black Peach Aphis in South Africa is mainly due to the labours of Mr. C. B. Hardenberg, now Government Entomologist to the Colony of Lourenco Marques.* The summary of the observations on the life history includes the following:—

* *Agric. Journ.*, Union of S.A., Pretoria, VI., No. 2, August, 1913, pp. 224-235.

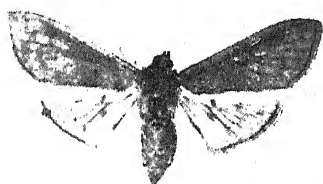


Fig Pyralid (*Polygrammodes hirtusalis*, Walk.) - adults - Nat. size.



Fig Pyralid Larvae
in various stages of
development.
Natural Size.



Larva of Fig Borer - Natural Size.



Chafer Grubs or White
Grubs - Natural Size.

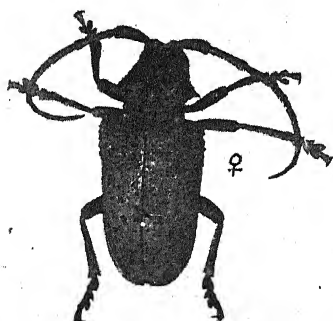


Fig Borer Beetles (*Phryneto spinator*, F.) - Natural. size.

(1) In sheltered situations the aphid probably hibernates on the trees, and may breed through the winter; (2) it attacks the young shoots and fruit buds, and also the leaves; (3) it is probably spread from tree to tree through the agency of winged individuals, which are produced as soon as a favourable mean temperature is reached; (4) the presence of the aphid at the base of the flower bud causes it to swell and open prematurely, or at least in advance of others which are not attacked by aphides; (5) the aphid is attacked by one hymenopterous internal parasite and preyed upon by two species of syrphid flies and three species of lady birds. Both species cause curling and dwarfing of the leaves.

Control.—Mr. Hardenberg demonstrated the efficacy of tobacco extracts in controlling the green peach aphid, and gives the following particulars concerning the use of these sprays:—(1) Tobacco extract in a solution containing about .082 per cent. nicotine is the most effective strength; no advantage is gained by using a stronger solution; this kills the aphid within 24 hours, being equivalent to a dilution of "Eagle Brand" extract of 1 in 100 and of "Lion Brand" extract 1 in 80; (2) the tobacco wash is more effective in sunshine than in dull cloudy weather; (3) the use of soap at the rate of 1 lb. in 25 gallons of spray is advisable; (4) for effective spraying an under-spray attachment is essential; the spray should be applied along the branch from below (towards the tip of the branch or twig), as the force of the spray will momentarily open the curled-up leaves; (5) by means of three effective sprayings a good crop of peaches can be secured even in badly infested orchards; (6) clean cultivation is essential, and cabbages, parsnips or cruciferous vegetables should not be grown during the winter in or near parts of the garden where peach trees are standing, as they furnish breeding places for the green peach aphid.

It should be noted in connection with the above that tobacco extracts of much higher nicotine content are now on the market. A 40 per cent. extract may be diluted at the rate of 1 in 400, or even more. As the black peach aphid is commonly found on peach during the winter, Mr. C. P. Lounsbury, Chief, Division of Entomology, Pretoria, recommends that advantage be taken of the bareness of the twigs to make a thorough application of the spray just before the buds open. Also that, should three sprayings as recommended not suffice to control the green peach aphid, applications should be continued at intervals of about five days.

2. Leaf-eating Beetles.—The foliage of some deciduous fruit trees is commonly attacked in the spring by various species of Chafer Beetles (*Melolonthides* and *Rutelides*). Young trees are sometimes defoliated year after year, and of course under such conditions fail to make growth and eventually become thoroughly unthrifty. Fruits which suffer particularly in this respect include grape vines, peach and apricot, but apples and other trees are also attacked.

There are numerous local species of chafer beetles which are on the wing for a brief period just after the opening of the rains, and each species seems to have some particular preference in regard to food.

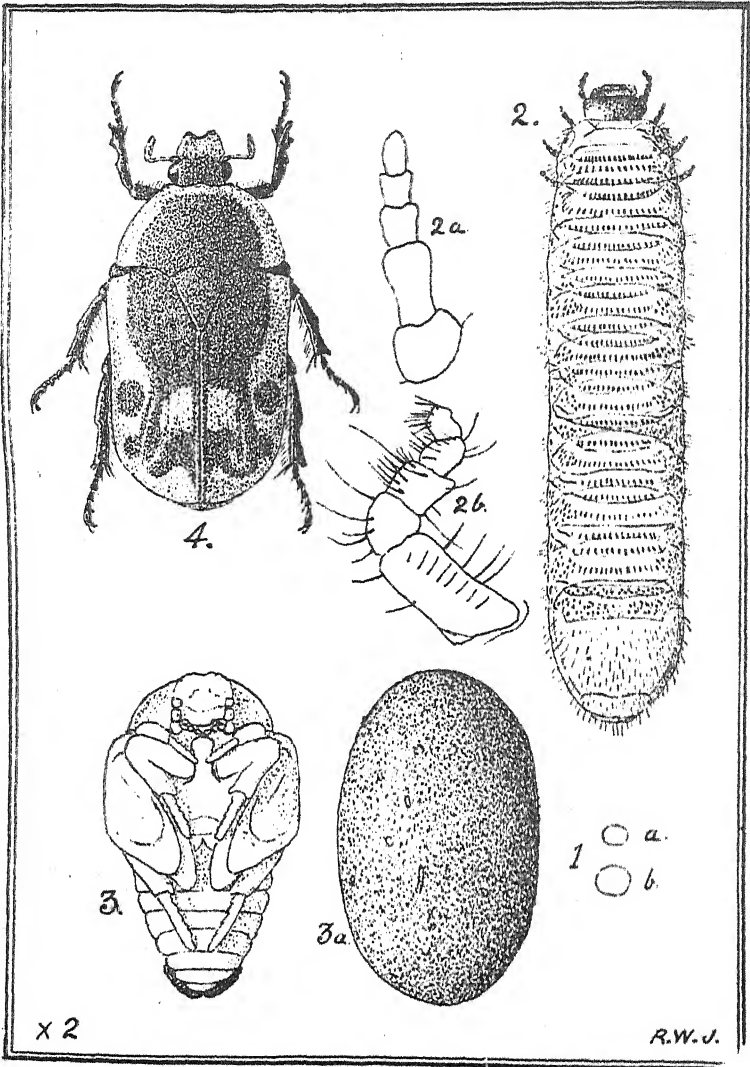


Plate XI.

Some species are enemies rather of the florist and amateur gardener than of the fruit grower, as their main attack is directed against blossoms of various plants, including rose, hollyhock, antirrhinum and many of the generally cultivated flowers. It is interesting to note that white and pale-coloured blooms seem to be preferred to those more deeply pigmented. Dark red antirrhinums and hollyhocks seem to be almost immune.

The food plants of the adult beetles and the life histories of the various species have received only casual attention to date, so that our knowledge in this respect is far from exhaustive. None the less the general facts concerning the life histories of several species have been ascertained, and notes have from time to time been made concerning the feeding habits of the adults of the common species.

On Plate XII. an attempt has been made to portray six species which are very common at Salisbury. This plate may seem somewhat technical as an illustration to a popular article, but the inclusion of certain structural details as a means of identifying the species is necessary on account of the fact that the correct name of the species is to some extent in doubt.* The publication of new facts concerning the life history and habits of a species under a doubtful name is, of course, calculated to lead to confusion. The writer has, therefore, endeavoured to make the identity of the species clear, whatever may be their correct designation.

The three species of *Anomala* are very partial to blossoms, although they will also eat foliage, and the same remark applies to *Adoretus flaveolus*. *Adoretus testaceus* is almost exclusively a foliage feeder, and perhaps the most injurious species of all to the fruit and rose grower. *S. manicana* has also only been taken feeding on foliage.

The beetles are practically nocturnal in habit, buzzing round the trees at dusk and gradually settling down to feed. During the day they bury themselves in the soil, and are to be found abundantly under the trees on which they feed. Here they lay their eggs, which are produced in considerable numbers. The larvæ or grubs are known as "white grubs" (see Plate X.). They are similar in form in all species, and live in the soil on the underground portions of plants, e.g., grass roots, and also apparently on humus. In many parts of the world they are destructive to small cereals, maize and other crops of the grass family, but have not proved great pests in this respect in Southern

* In this connection it may be stated that the four species described by Dr. Peringuey—namely, *Anomala eritialis*, *A. pinguis*, *Adoretus flaveolus* and *Schizonycha manicana*—are undoubtedly correctly identified, although some of the names may be synonyms. *A. eritialis* was originally identified by one authority as *A. pallida*, F., and *S. manicana* as *S. puncticollis*, Bhn. Of the two remaining species, *A. dorsata*, Bhn., was also identified as *Adoretus picticollis*, Bhn. *Adoretus testaceus*, Bhn., appears to the writer to be a doubtful identification, as the form of the male genital armature is not the same as Dr. Peringuey's figure.

Rhodesia, although a few instances of damage to maize and cereals have come to notice, and also in one instance quite appreciable injury to tobacco. They also attack garden plants, such as antirrhinums, etc.

The life histories of the species of *Anomala* and *Adoretus*, which belong to the *Rutelides*, have been found similar in the few species bred through. The eggs are mostly laid from late October to December, and the grubs grow rapidly, attaining full growth at or shortly after the cessation of the rains in April and May. They then construct cells in the soil, in which they rest over the winter. Pupation takes place in these cells with the advent of warm weather in the spring, possibly mainly in September, the adult breaking the pupal skin a few weeks later, but resting in the cell until the rains. A comparatively small shower of rain seems sufficient to bring out some of the adults as early as October, but they appear in their greatest numbers only after a good soaking rain has fallen.

Schizonycha manicata, Per., which belongs to the sub-family *Melolonthides*, has a slightly different life history. It is amongst the earliest of the chafers to appear in the spring, being frequently abundant in October before any rains have occurred. The grubs are of apparently similar habits to those of the *Rutelides*, but become full fed by March and pupate immediately. A pupa collected in the field on 17th April yielded an adult on 9th May, and adults have frequently been dug out of their cells during the winter. This species, therefore, over-winters as an adult, and apparently assumes an active adult existence with the flushing into leaf of its food plants in the spring.

It is to be noted that all the species studied complete their life cycle in one year, and that none of the grubs feed during the dry season, at least not after the soil has dried out to an appreciable depth.

Control.—Heavy spraying with a good brand of lead arsenate has given good results in the writer's experience, and has been well reported on by others who have tried it. The paste form of this compound was diluted at the rate of 1 lb. in 12 gallons of water, and the application was very thorough. Arsenate of lead is now mostly sold as a powder, which should be diluted at the rate of 1 lb. to 24 gallons of water. This preparation probably acts to some extent as a repellent, but as the same beetles appear to attack the same tree night after night, its action as a poison might be of considerable value. It is desirable that further observations be made to ascertain its exact action. All that can be said at present is that it appears to protect the trees.

Mr. R. L. Thompson, late of this branch, reported protection lasting about a week from spraying the trees with resin wash, the formula for which is given later.

3. Other Leaf-eating Insects.—Any other leaf-eating insects, such as small beetles (*Chrysomelidae*) or caterpillars, which attack the foliage should be dealt with by spraying with arsenate of lead (powder), 1 lb. to 30 gallons of water, or arsenate of lead (paste), 1 lb. to 16 gallons of water.

4. Bryobia Mite (*Bryobia pratensis*, Koch?).—When the writer first arrived in Rhodesia he paid considerable attention to the gardens of Salisbury in expectation of finding this mite as prevalent as in some high-veld towns of the South African Union, but until last year the pest found no place in the office records at all. In August, 1922, however, specimens of apple branches thickly clustered in the typical manner with eggs of apparently this species were received from a locality near the eastern border, where conditions are of course somewhat different to those in most other parts of the Territory.

As the mite must have been introduced repeatedly in the past from the south, its apparent failure to establish itself in the larger towns in Rhodesia appears to indicate unsuitable climatic conditions. In the Union it has a wide distribution, and is found in areas of both summer and winter rainfall.

The adult *Bryobia* mite is a minute eight-legged creature, and is sometimes confused with the common Red Spider (*Tetranychus*). It may be distinguished, however, by the fact that it is larger and spins no web. In trees the eggs are laid singly on the bark, frequently in depressions, but when abundant they may cover the branches and give them a distinct reddish hue. The underside of the branches is much preferred for oviposition. The newly hatched mite has only six legs, as in practically all members of this order, but attains eight at the first moult. Generations succeed each other rapidly throughout the summer, but the mite passes the winter in the egg stage.

The mites feed on the growing leaves and on the blossom. When abundant, the foliage loses much of its green colour and becomes mottled. Premature dropping may occur, and the trees in general become unthrifty and unprofitable.

The mite is found on a wide variety of hosts, including clover, lucerne, barley, grasses, buckwheat, etc. Fruit trees stated to suffer in California are:—Pear, and practically all the stone fruits, such as apricot, peach, plum, prune and almond. At the Cape Lounsbury records pear as being the host in most complaints received at the office, but stated that prunes suffer badly, domestic plums rather less than prunes, but much more than Japanese plums.

Control.—Late winter spraying with full strength lime sulphur wash (see under "Scale Insects") is effective. This does not apparently have a great effect on the eggs, but the young which hatch out are gradually eliminated from sprayed trees.

In the summer, when the trees are in leaf, the grower has the choice of several sprays—namely, lime sulphur at summer strength, resin wash at full strength, paraffin emulsion or tobacco wash and soap.

The lime sulphur concentrates on the market would need to be diluted to about 1 in 80 for this purpose. Resin wash and paraffin emulsion are dealt with under "Scale Insects" later, and tobacco wash under "Woolly Aphis." It is to be noted that lime sulphur cannot

safely be used on certain varieties of trees when in foliage, even at great dilution. The wash used should be applied in a soft misty spray through a cyclone nozzle.

INSECTS WHICH ATTACK THE TRUNK, BRANCHES OR TWIGS.

1. **Borers.**—With the exception of the fig, fruit trees in the Territory are not much attacked by borers, and, as far as present experience goes, not at all by moth borers, that is to say by the caterpillars of certain species of moths of the families *Cossidae* and *Egeriidae*, which are frequently injurious in this manner in other parts of the world. The grubs of certain beetles are, however, injurious, including those of the *Bostrichidae*, a family of cylindrical beetles, several members of which cause the rapid destruction of native timber when used for buildings and other structures. These beetles have been reported as attacking mango, but so little is known of their habits that it is not possible to recommend control measures with any confidence.

The fig is, however, very commonly injured by the grubs of a large long-horned beetle bearing the name of *Phrynetia spinator*, F. (see Plate X.). This is a native African insect, and for a detailed study of its life history and means of control we are indebted, as in several other instances, to Mr. David Gunn, of the Union Division of Entomology.

The principal food plants of this insect are stated to be willow and cultivated fig trees, although eggs may be deposited on pear and peach trees growing near to infested trees of the more favoured species.

The female beetle makes an incision in the bark with her jaws, and in this she inserts her egg. Then she covers it over with a gelatinous substance. Eggs were observed to be deposited practically throughout the wet season at Pretoria, and this would presumably be the case in Southern Rhodesia. The position chosen for egg-laying is almost invariably from half an inch below to 12 inches above the soil on the main stem. Eggs are not deposited in branches. The eggs hatch in from ten to eighteen days.

The young grub feeds at first on the bark, but gradually works its way inward, and at the age of about one year measures nearly one inch in length and has penetrated to the solid wood. From Mr. Gunn's observations the larval or grub period occupies over two and a half years, larvæ from eggs which hatched in December and January, 1914, commencing the preparation of their pupal cells in June and July, 1917, and pupating from September to November the same year, the adults appearing about three months later. The whole life cycle thus occupies approximately three years.

The beetles themselves have frequently been taken at Salisbury during January gnawing the twigs of the trees. They are also stated to eat the rind of unripe figs and to do appreciable damage in this way.

Control.—Mr. Gunn is strongly of opinion that, for effective control of this pest, fig trees should be trained to a single stem. The

Cerophlasia or Wax Scale on Wild Fig



Saissetia Scale on Custard Apple



Aspidiotus pectinatus, Lind (?) on Guava.



Tachardia Scale on Custard Apple.



Chionaspis Scale on Wild Fig.

difficulty of dealing with a tree which has four or five stems springing directly from the ground is obvious, whether from the standpoint of adopting measures of protection or of ridding the tree of its undesirable inhabitants. A single main stem from 12 to 18 inches in length can be easily handled, and the advantage of this is clearer when one recalls that, according to Mr. Gunn, the attack is practically confined to the lower 12 inches of the stem, the branches being apparently immune.

When a tree is infested, the problem resolves itself into two parts—firstly, to get rid of or destroy the borers in the wood; and, secondly, to help the tree to heal the wounds received. Borers which are near the surface can be cut out with a strong knife, care being taken to make only *vertical* cuts in the bark, as these heal readily. The borer can be located by the presence of the sawdust-like material which is thrown out. After the grub has been located, the knife or the point of a flexible wire can be used to destroy it. Grubs which have penetrated far into the roots must, however, be destroyed by injecting about two ounces of carbon-bisulphide into their burrows and closing the hole with a wad of clay. Wounds should be painted over with paint or coal tar, in the latter case care being taken to confine the tar to the wounds. Very badly infested trees should be cut out and the infested portions burnt.

Mr. Gunn found that the best and most practical means of protecting the trunk was to enclose it loosely in wire gauze from the roots to the base of the branches. It is necessary that the gauze should not be in close contact with the trunk, but stand out an inch or two from it, except where secured with strong twine at top and bottom. Paper fasteners are used to hold the edges of the gauze in contact with each other. The bottom end of the gauze cylinder should rest on the roots, and soil should be heaped up against the gauze at the base of the tree.

From what is known of the life history of the insect, protection is only necessary from October until the end of April; the gauze should be removed during the winter and replaced the next October.

2. Scale Insects.—Although of prime importance as enemies of deciduous fruit trees in most parts of the world, including the South African Union, scale insects have not as yet proved highly injurious to this class of tree in Southern Rhodesia. A number of species have, however, been recorded on the trees under consideration from time to time. Apples on the eastern border farms are commonly infested with the so-called Greedy Scale (*Aspidiotus rapae*, Comst.), although apparently never to an injurious extent. This species has also been found on pear, pomegranate and guava. Red Scale (*Chrysomphalus aurantii*, Mask.) sometimes attacks pears, and has been observed heavily infesting white mulberry. Oleander Scale (*Aspidiotus hederae*, Sign.) has been found on Japanese plums, and in at least one case the tree was heavily infested and obviously in very bad health, but whether the bad health of the tree was due to the scale or the abundance of the scale due to the unthrifty condition of the tree was not clear. Guavas are commonly infested with a whitish scale which appears to be *Aspidiotus*

pectinatus, Lind., and branches are sometimes stunted by its attack, but in general it does not increase sufficiently vitally to affect the tree. Figs are attacked by a native Wax Scale (*Ceroplastes* sp.). A species of *Ceroplastes* is shown on Plate XIII., and outwardly at least resembles that attacking fig, but the host is in reality the native "Mnondo" tree (*Berlinia* sp.), as fresh material of fig could not be procured when needed for photographing. Fig is also attacked by a dirty whitish pear-shaped scale (*Chionaspis* sp.), which is also found freely on wild *Ficus* sp. Custard apple suffers to a considerable extent from a species of *Saissetia* and another scale (*Tachardia* sp.), both of which are shown on the plate. The *Saissetia* scale, in common with the generally prevalent Soft Brown Scale (*Coccus hesperidum*), has a predaceous enemy in the form of a curious caterpillar, the larva of a moth (*Eublemma scitula*, Rmlr.). This caterpillar is, as far as is known, purely carnivorous, feeding directly on the scale. It is protected by a scale-like covering, which it carries about with it in its movements along the scale-infested branches and twigs. Three of these insects are shown in the photograph. Soft brown scale commonly attacks mango at Salisbury, and in point of fact young trees are reported to have been killed by it. Some other scales also attack this tree.

Scale insects are mostly small or minute, although the famous Mammoth Scale (*Aspidiotus proctus maximus*, Newst.) of this Territory, the largest known species, measures up to an inch in diameter. It is not, however, a pest of fruit trees, but lives on *Brachystegia* and some other trees mostly native to the Territory. Young scales possess six legs like other insects, and in some species legs are retained throughout the insect's life. In others, as in the armoured scales, the legs are lost at the first moult, and the insect is no longer capable of moving about. The scales as usually noticed are the adult females. The adult males are frail two-winged insects and do not feed. In some species males have never been observed, the females reproducing generation after generation parthenogenetically. Some scales lay eggs, others produce their young alive. The insects feed by means of a relatively long slender proboscis, which is inserted into the tissues of the plants. The draining of the plant juices interferes with its development, and may cause local death of the tissues. Some scales are, however, thought to produce a definite poisonous effect on the tissue (e.g., red scale). Certainly some are more injurious than others, quite apart from the numbers present.

In a popular article of this nature it is considered unnecessary to go into details with a view to placing the reader in a position to recognise different species of scales. Plate XIII. is designed to give the uninitiated an idea of the general appearance of several scales which may attack fruit trees in the Territory. The fruit grower should note, however, that scale insects are divided into two classes—namely, those which are protected by a secretory covering, generally referred to as "armoured scales," and those which generally lack such protection, termed "soft scales." The various species of *Aspidiotus*, *Chrysomphalus* and *Chionaspis* fall into the category of armoured scales, which are relatively small, whilst *Coccus* (*Lecanium*), *Saissetia*, *Tachardia*

and *Ceroplastes* are soft scales. *Ceroplastes* is, of course, protected by a heavy waxy secretion, but it is more closely related to the soft scales than to the true armoured scales. The presence or absence of a protective covering and the nature of the latter have considerable bearing on the efficacy of insecticidal washes and fumigants.

Control.—A very great amount of investigations have been devoted to methods of fighting scale insects on fruit trees, and as a result we are in a position to control some of the most injurious species in a more or less satisfactory manner by means of sprays or fumigation, but certain kinds are less amenable to treatment than others.

The Wax Scales (*Ceroplastes*) are well protected by their waxy covering, and it is therefore necessary first of all to scrape as many as possible of the old scales off the branches, and then to spray the tree thoroughly with a strong contact insecticide in order to kill the young. The latter are produced in great numbers and settle largely on the leaves. They are pretty star-like objects on account of the fringe of white wax flakes which surrounds their bodies. The young can be destroyed by spraying with paraffin emulsion, resin wash or miscible oil. In Italy the use of lime sulphur wash is recommended. Fortunately these insects, which are native to Africa, are largely kept in check by their natural enemies, and action on the part of the grower is rarely necessary.

Bulky scales such as those of the genera *Saissetia* and *Tachardia* in a large measure protect their eggs or newly emerged young with their own bodies, and sprays are only effective against the young after they have left the protection of the mother scale and before they have developed to any great extent on their own account.

The armoured scales also afford protection to their eggs or young in a degree varying with the species, but *Aspidiotus* and *Chrysomphalus* at least are not difficult of control by proper methods. Of all the scales mentioned, the Soft Brown Scale (*Coccus hesperidum*) is the most easily killed by contact sprays.

Spraying formulæ used against scale insects may be divided as they are intended for use in winter on deciduous trees or on trees in foliage. Naturally stronger preparations can be used on dormant trees, and of those winter sprays the two best known in South Africa are lime sulphur wash and miscible oil.

REMEDIES FOR SCALE INSECTS.

Winter Washes for Dormant Trees.

Lime-sulphur Wash is, as its name implies, a combination of lime and sulphur, and may be prepared at home, but this is now very rarely done, as commercial preparations are on the market at a reasonable price and are in general much to be preferred. The lime-sulphur concentrate manufactured in South Africa is recommended for use at a dilution of 1-10 on dormant trees against scale. On trees in foliage it must be diluted to a much greater extent, and the value of lime-sulphur against scale under such circumstances is doubtful.

Lime-sulphur has apparently little direct action on the adult female scales, but, if strong enough, it has an excellent effect on the young, and appears to be of particular value against those species in which the young settle down on the bark. The lime-sulphur adheres well, and the young are unable to settle on bark which is covered with the preparation, so that thorough spraying affords continuous protection as long as the wash clings to the tree. In this respect this wash is in a class by itself.

Miscible Oils consist of preparations of mineral oils, which should mix readily with water. Several brands are on the South African market, amongst which may be mentioned "Scalecide," "Harbas" and "Gargoyle Red Spraying Oil." These should be diluted according to directions on the container. They are valuable as winter washes for deciduous trees, but, although directions for dilution for use on trees in foliage are given, they must be used with care on such trees, as serious defoliation may result.

Washes for Trees in Foliage.

Resin Wash.—Notwithstanding the fact that in California, where resin wash was originally used as a spray against scale on citrus trees, this wash has apparently fallen largely into disuse, under Rhodesian conditions nothing better has yet been found as a spray for trees in foliage, and it is extensively used in the citrus plantations. It is harmless to foliage, and kills such scales as Red Scale (*Chrysomphalus aurantii*, Mask.) and its allies, as well as the prevalent Soft Brown Scale (*Coccus hesperidum*), in a satisfactory manner. This preparation is manufactured in a concentrated form by a South African firm, but it is usually prepared at home. The formula is as follows:—

Resin	...	...	...	...	24 lbs.
Caustic soda, 98 per cent.	...	...	...	...	5 lbs.
Ground nut, raw linseed or fish oil	...	...	...	...	2 bottles.
Water to	...	...	...	...	100 gallons.

Crush the resin, which may easily be done by pounding it in a meal sack, put 15 gallons or more water in the cooking pot, stir in the soda and oil, and bring to a boil. Then gradually stir in the powdered resin, never letting any settle, and boil for ten minutes after all is dissolved and the solution is like strong coffee in colour. The preparation may take less than three-quarters of an hour if the resin is well crushed and not allowed to settle, but may take two or even three hours if the resin collects in a mass. Add hot water, or cold water very gradually, if mixture foams up strongly, and when cooking is complete bring amount of liquid up to 25 gallons at once. Good until used, and should keep without settling; if it settles, boil until all again dissolved. Remaining water, hot or cold, may be added at any time.

When made without oil, the wash seems practically as good as with it for soft scales and for aphides. If oil is not procurable and the wash is needed for hard scales, use 6 lbs. of good soft soap in its place.

Resin wash at two-thirds the strength given is strong enough for most aphides, but for woolly aphis full strength wash had best be used.

Paraffin Emulsion.—This is rather a favourite wash with gardeners, but is dearer than resin wash, not so reliable against scale insects, and it is apt to injure tender foliage. It is prepared as follows:—

Soap	...	...	...	...	1 lb.
Paraffin oil	...	...	...	...	4 gallons (1 tin).
Soft water to	...	...	...	...	60 gallons.

The soap should be cut into thin flakes (unless soft soap is used) and boiled until dissolved in 2 gallons of water (preferably rain water). The vessel should then be removed from the fire, the oil added and the whole pumped vigorously through the spray pump with the nozzle directed back into the vessel. It forms a thick emulsion, which may be termed the stock emulsion. This should keep for some months without separating. For use against scale, dilute the stock emulsion with nine parts of water. As a winter wash it is sometimes used at a dilution as small as 1 to 4 or 5. Against plant lice (aphides) 12 to 15 parts of water may be used. If soft water is not available, the hard water should be softened by the addition of a little washing soda or borax.

Soap Wash.—When only a few small trees need treatment, soap wash is sometimes a convenient preparation, but it may injure delicate foliage. A good soap should be used, whether hard or soft. Against hard scales use 1 lb. to 2 gallons of water, against soft brown scale 1 lb. to 3 gallons, against woolly aphis 1 lb. to 4 gallons, and against naked aphides 1 lb. to 6 gallons (Lounsbury).

3. Woolly Aphis (*Eriosoma lanigera*, Hausm.).—Although this insect attacks trees from the foliage to the roots, it is included in this section because of the conspicuous swellings it causes on the branches. It is common in the South African Union, and has been located in one locality close to Salisbury. Probably it occurs elsewhere in the Territory.

The woolly aphis is related to the better known green fly of roses and other aphides, but the actual insect is largely concealed by a white woolly secretion, hence its popular name. Its life history has not been followed in the Territory, and probably differs in certain particulars from that recorded in more temperate climates.

The fruit grower or gardener will notice the aphis chiefly on the swellings it causes on the branches, where its white woolly covering renders it conspicuous. The damage caused to the aerial portion of apple trees is not in general particularly important, although young trees may be much deformed. The insect, however, also attacks the roots, causing similar knots and swellings, which may interfere considerably with the nutrition of the tree and even cause its death. This form of attack is very difficult to deal with, but is in general avoided by growing the trees on what are known as "blight-proof" stocks.

Woolly aphis is primarily a pest of the apple, but has been found on pear, hawthorn and some allied trees. In America the elm is stated to be the chief winter host.

Control.—This insect is not as easily killed as some other aphides, and, as it reproduces very rapidly, thorough measures are necessary. Above ground the most effective preparation appears to be tobacco or nicotine wash, but paraffin emulsion (1-9) is also used. A forceful spray is necessary for the best results, as many of the aphides are hidden in crevices in the bark.

It is best to use a proprietary brand of tobacco extract rather than to attempt to prepare the wash at home, as the nicotine content of tobacco leaves and stalks varies greatly. The tobacco extracts on the market, however, also vary greatly in this respect. A good brand contains about 10 per cent. nicotine, but brands are on the market containing as much as 40 per cent., whilst nearly pure nicotine can also be purchased. The user must be guided by the strength of the extract employed. An extract containing about 10 per cent. nicotine should be diluted with 150 parts of water, the 40 per cent. extracts with 600 parts, while in the case of nearly pure nicotine only some 5 to 6 fluid ounces are needed in 100 gallons of water.

About an ounce of soft soap should be added to each gallon of liquid used, as this considerably assists the action of the nicotine. On trees which only show a few colonies of the aphis, these should be brushed out with *double* strength resin wash, paraffin emulsion, warm soap suds at 12 ounces to the gallon (the heat is necessary to keep it fluid at this strength), or tobacco decoction, 1 lb. waste tobacco to the gallon (Lounsbury).

Treatment underground should never be necessary in this Territory, as all the leading South African nurserymen grow the whole of their apple trees on "Northern Spy" (blight-proof) stocks, and in point of fact the importation of apple trees on other stocks is prohibited under the Importation of Plants, etc., Regulations. Paraffin emulsion is usually used against the pest on the roots, the soil being soaked when dry to a depth of 3 to 4 inches.

SOME PESTS OF FRUITS

*Prevalent in the South African Union and not yet Recorded
in Southern Rhodesia.*

It may interest our readers to know that several important pests of fruits other than citrus in the South African Union have not yet been found to occur in this Territory. These include:—

- (1) Apple Codling Moth (*Cydia pomonella*, L.).
- (2) Pernicious Scale (*Aspidiotus perniciosus*, Comst.).
- (3) Peach Scale (*Diaspis pentagona*, Targ.).
- (4) Apple and Quince Borer (*Coryphodema tristis*, Drury).

Breeding for Increased Egg Production.

By H. G. WHEELDON, Assistant Poultry Expert.

Poultry-keeping is receiving an amount of attention at the present time in Rhodesia which it never received before. People are beginning fully to realise the importance of this branch of agriculture, and the possibilities of success are being readily admitted even by those who formerly regarded fowls in a very sceptical manner. The days when the poultry-keeper's knowledge consisted only of the hard and fast rules and a few elementary principles have in many cases happily gone from us. In the place of this old-fashioned machine-like personage has come an army of men and women who seek for knowledge and enlightenment in one of our great industries.

There is, however, an ever-present danger that the beginner may minimise the difficulties and over-estimate his own capacity, imagining that what others have done he can do. It is entirely a question of individual capacity, since one man will succeed, while another will commit blunder after blunder until the inevitable end is failure.

There are several fundamental principles which should be studied by every beginner. A clearly-defined plan should be mapped out as to what the ultimate object is going to be, and all energies should be directed towards this end. Commence in a small way, whether it is to be the supply of market eggs, eggs for hatching or breeding stock, or perhaps all three.

Poultry-farming to-day does not consist solely of the proper feeding and management of fowls, but includes, among other things, breeding for high egg production. We must accept the fact that breeding for high egg production is just as possible as the breeding for increased milk production in the dairy cow. If egg production, then, is to be our main object, we should give our attention to noting which hens lay the most eggs, then use them for breeding stock, and mate them with males from hens which we know have a good record for laying.

The demand for breeding stock and eggs for hatching is undoubtedly on the increase, and during the breeding season is greater than the supply, and the prices for good stock and eggs are very remunerative. We have arrived at the time when the breeder will be asked to supply hens and cockerels for breeding that have pedigree laying qualities, and breeders should make a start with this end in

view. The public will buy from the breeder whose birds put up the biggest egg record, and the man who can meet this demand will realise good prices for his stock and eggs for hatching. To do this there is no more certain, satisfactory and reliable plan than to trap-nest or single-pen the pullets and breed from the best as second-season hens.

The poultry-keeper should go through the young stock each year, and pick out the best and likeliest layers among the pullets, pen them away from the rest and keep their egg records, so that those which prove themselves unworthy of a place in the breeding pen after their first season may be discarded, and only the best used for breeding purposes. There are many individual fowls to-day that will lay 250 eggs and more the first year, but a large flock of birds that will average 150 eggs each may be considered very good, and the higher the average that can be worked up above this figure the more profitable will be the laying birds for market eggs. I am convinced that if all those who keep fowls were to adopt more up-to-date methods of this kind their birds would yield them a greater return than is the case at present. Breed only from the best proved layers; there is then every likelihood of the production reaching the maximum. The breeder of poultry who sells breeding stock and eggs for hatching and those who wish to attain a high flock average from their laying birds must know the best layers, and must adopt some plan of knowing the chicks from certain hens and select for the breeding pens only such hens as have established a good record as layers. In a pen of selected pullets to be tested put a series of trap-nests. It may be difficult perhaps at first to get pullets into the way of using trap-nests. Some birds when coming into lay are shy to enter them, and will deposit their eggs in any other than the right place. A good plan, however, to accustom the young fowls to the trap-nest is to put them when they are well grown in a house that has such nests, allowing them to enter and leave the boxes at will, the trap being kept up or fastened, while odd nests they themselves make are immediately destroyed. Thus they become trained to act as they should do, and enter the trap as freely as they would go into any other artificial nest.

Trap-Nests.—There are now many trap-nests of various designs, and all no doubt serviceable. Many poultry-keepers prefer to make such small appliances for themselves, so the accompanying sketches of two designs of trap-nests and their description should enable the handy man to select and make something that will suit his purposes. Both of those shown in the accompanying illustration are very simple, inexpensive, easy to attend to, and certain in their action.

The first is a box-like structure, 28 inches long, 15½ inches wide and 15½ inches deep, outside measurements, which may be made as indicated in the sketch, with a lid covering the whole of the box, or without lid if used in a block form. A division board with a circular opening 7 inches in diameter is placed across the box 12½ inches from the rear end and 15 inches from the front end. The rear section is the nest proper. At the top and a little in front of the division board a piece of board ½ inch by 5½ inches by 13½ inches is placed

across the box. At the entrance a light frame of $\frac{3}{4}$ inch by $1\frac{1}{4}$ inch material is covered with wire netting of 1 inch mesh. The door is 11 inches wide by 10 inches high, and does not fill the entire entrance, a space being left at each side to avoid friction. It is swung at the top by a stout piece of wire running the width of the door and extending into sockets, and supported by wooden blocks, one on each side. The trap consists of a piece of stiff wire about $\frac{1}{8}$ inch in diameter and 17 inches long. This piece of wire is shaped so that a section of it, 10 inches long, rests directly across the circular opening in the division board. The next section of the wire is $5\frac{3}{4}$ inches long, and it is bent so that it is at right angles with the 10 inch section, which is let into a slot in the material at the top of the division board, and held in place by two staples, but loosely enough so that the wire can roll easily from side to side. The remaining section of the wire, which is $1\frac{1}{4}$ inches long, is bent down parallel to the 10 inch section and again bent at right angles to it, so that it supports the door when it is open and rests upon it at A. As the pullet passes in under the open door and then through the circular opening to the nest, her neck presses against the perpendicular wire as she passes it, and the end at A, supporting the door, slides from under it. Thus released, the door swings gently down till it reaches the leather stop, passing a wooden button on the bottom of the box at the entrance, which locks it and prevents the hen from escaping and others from entering.

The trap-nests, if to be used in block form, are placed four or more in a block, and slide in and out like drawers, and can be taken out for cleaning when necessary. Six nests in a pen accommodating 20 pullets may be found sufficient, and the attendant should visit the pen once an hour, or a little oftener during that part of the day when the hens are busiest. Earlier and later in the day his visits need not be so frequent.

The double box, with nest in the rear, is necessary. When a hen has laid an egg and desires to leave the nest, she steps out into the front space and remains there until she is released. With only one section she would be likely to crush her egg by stepping upon it, and thus learn the pernicious habit of egg-eating. To remove the pullet the nest is pulled partly out, and as it has no cover she is readily caught, the number of her leg-band is noted, and the proper entry is made on the record sheet. After having been taken off a few times the pullets do not object to being handled; most of them remain quiet, apparently expecting to be picked up. Before commencing the use of trap-nests it was thought that some hens might be irritated by the trapping operation and object, but this does not seem to be the case.

A disadvantage of trap-nests is the fact that the bird is a prisoner until liberated and may be left too long in the nest. This applies particularly to the farmer who has many calls during the day, and he is, sometimes unavoidably, apt to neglect the nests. To minimise this difficulty, a useful device is shown in the second illustration. A small wire run, the width of the box and closed in on top, may be

attached and extended 4 feet at the rear of the box, which will admit the bird till such time as it may be released and recorded. A vessel containing water can be placed inside the run, to add to the comfort of the bird for at least a few hours. A row of nests may be placed in the shade of trees, or put in such a position that the shade falls on the nests during the hottest part of the day.

The nests, which should be made of stout wood, may measure 13 inches from front to back, 15 inches high and 24 inches wide. These and other dimensions are approximate only, and could be varied to suit odd boxes and nests at hand. The depth from front to back should not be less than 18 inches. Two openings should be cut out opposite to each other, one in the front and the other in the back of the box.

The above shows the trap open: and, as the bird enters, the trap is pressed slightly to one side, the trigger, being relieved of its pressure, falls into the opening at A, and as the bird enters the box the trap gently falls down till it reaches the opposite side of the opening, and is locked by B, which prevents the hen escaping. When the hen desires to leave the nest, she steps out into the small run attached to the box and remains there until released.

Single Pens.—To test pullets in single pens, housing accommodation will have to be provided for each bird. The houses should be open-fronted, with the exception of a board 1 foot high along the bottom, to prevent the scratching material from being thrown out into the run. The house may be 4 feet high in front, 4 feet deep and 3 feet 6 inches at the back, and may extend unbroken for a considerable length, being divided by wire-netting partitions every $2\frac{1}{2}$ feet. It is advisable to have a solid partition every 20 feet to break the draught. The runs to each pen can be 15 feet long, $2\frac{1}{2}$ feet wide and 6 feet high. The sides of the houses may be made of any suitable material and the roof of zinc. The back should consist of the doors, divided by a narrow piece of boarding upon which to hinge and fasten the doors. Each compartment must be supplied with a covered nest box, the nests being placed back to back, and a perch is let through the wire partition, extending the full length of both nest boxes, the tops of which are 4 or 5 inches below the perch and serve as dropping boards.

When the pullets become restless and start "reddening up" and the combs begin to enlarge, it is a sign they are going to lay, and it will be necessary to select the ones you intend breeding from as tested second-season hens. Ring them for identification and future reference, and place them in their respective compartments.

Commence to Select the Pullets Early.—Early maturity, with normal size and development, is a valuable point to be guided by, as these are indications of vigour, constitution and high productiveness. Early maturity is usually accompanied by other desirable qualities which are most valuable essentials for future progress and should be keenly perpetuated in every strain.

It will be noticed that some of the pullets will grow away from the rest. This should be encouraged by going through the young stock

from time to time during their growing period and picking these out, to be penned together away from the rest to avoid overcrowding, and give these special care and attention, as they will generally make the best breeders.

After the test, if careful records have been kept, it will not be difficult to select the best layers for the breeding pen. Any birds that fall broody, if of the light breeds, should be discarded, as well as those which might have been sick during the test. An ideal mating for best average results is:—Hens, 240 to 250 eggs per annum, mated to cockerels from 260 to 280 egg hens.

Records.—When one decides upon building up a great strain of pedigree layers it is absolutely necessary to keep an accurate record of every egg laid by each bird.

An egg record of the flock as a whole or of individual layers may be kept as indicated on the accompanying chart, and may be modified to suit the purpose of the poultry-keeper. It really needs no explanation, although perhaps it ought to be mentioned that in the case of single-penning the chart as above may be kept posted up in each run, where it could be left for the whole period of the laying test, entering the eggs laid each day opposite the number of the bird. The above chart may also be used for recording up to twelve individual hens or pens as required.

The poultry-keeper may not depend entirely upon sample forms or suggested methods of keeping records, but could draw out convenient forms especially suited to his conditions and purposes, so that they will contain in condensed form just the information desired for future reference.

Mark the Chicks for Identification.—For keeping a record of the chickens there is no better method than toe-punching them, as if several blood-lines of one breed are kept, for example, in the case of line-breeding, confusion is bound to follow, especially if only rings are used, as these are likely to drop off.

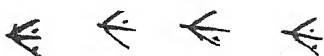
Toe-punching means the perforation of holes in the web of the chicken's foot, and is easily and practically painlessly accomplished just after the chicks are hatched, the eggs of the different hens being divided off in the egg drawer of the incubator for this purpose. A toe-punch can be bought at a very low cost and will last for years. The Midget toe-punch is confidently recommended. There are no less than sixteen variations which can be made in toe-punching, as is shown below, so that no difficulty will be experienced in keeping a correct record of each of the strains.

EGG-LAYING CHART.

[illegible]

D—Died; I—Introduced; W—Withdrawn; X—Double yolk; B—Broody; S—Soft shell;
P—Month for single-egg records; R—Number for trap-nest or pen records.

NOTES.—Weather very hot and dry, etc.

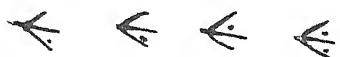


(13)

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(16)

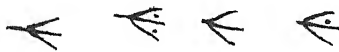
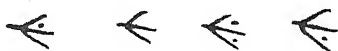


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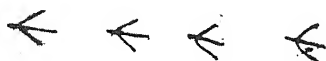


(5)

(6)

(7)

(8)



(1)

(2)

(3)

(4)

The above diagram shows the method of marking the chicks so that sixteen different flocks, ages or families may be identified by the absence of punch marks as in No. 1 and by punch marks as shown in Nos. 2 to 16. Newly hatched chicks should always be punch-marked, and a record kept of the date on which they were hatched. Later the marks can be supplemented by leg-bands, making it possible to positively identify many ages, flocks or families.

The plans followed are based upon every-day practical common sense. Individual records of performance must be kept. The large producers are mated with sons of large producers. Line-breeding should be followed and in-breeding strictly guarded against. By line-breeding is meant the mating of parents to their offspring. In-breeding, in the sense used by poultry-keepers, implies the union of close blood relations or union of birds possessing the very same elements, such as brothers and sisters, which is the worst of all. It is doubtful if the in-bred hen has sufficient constitution to enable her to withstand the demand of heavy egg-yielding.

Irrigation Notes.

The number of irrigation schemes taken in hand throughout the country continues to increase steadily, and amongst those recently completed or under consideration are the following:—

Old Umtali Combined Irrigation Scheme.—Under this scheme it is proposed to divert water from the existing main canal of the Odzani Irrigation Board and bring under irrigation about 1,000 acres of land on the farms Alvi, Fairview and Old Umtali Mission. Preliminary surveys have been completed, and the scheme has been found feasible from an engineering point of view. The application for the creation of an Irrigation Board by those interested in the scheme will come before a Water Court at an early date, and when its decisions have been given it is anticipated that construction of the necessary works will then be taken in hand.

Major Hastings, Maringowe, Headlands.—A small scheme consisting of a weir and pipe line has recently been carried out, and in the coming season it is hoped to put a considerable area under irrigation for the growing of green feed crops, etc.

Mr. A. C. Staunton, The Grove.—A concrete diversion weir about 5 feet in height has been erected in the Umwindsi River at the

head of the main furrow. This necessary work completes the scheme taken in hand by Mr. Staunton during 1921, and which he has found of such great value for growing green feed for his dairy stock, etc.

Messrs. McDougall & Spraggan, Triangle Ranch.—Investigations and surveys have been carried out during the past dry season for an irrigation scheme utilising the Mtilikwe River, in the Ndanga district. This river in its lower reaches has a very well sustained normal flow, and is therefore capable of irrigating a very large area. On the ranch there are over 2,000 acres of rich soil, which, by means of a small diversion weir in the river and a canal about ten miles in length, can be brought under irrigation. In this district, lying in the semi-arid belt, irrigation is often necessary for summer as well as winter crops. Messrs. McDougall & Spraggan propose placing large areas under cotton, and there appears to be no reason why this should not be done successfully. It is pleasing to see some attention at last being given to these lower lying areas, in which are situated some of the richest lands in Rhodesia, and which must be developed for sub-tropical and other crops before Rhodesia can come into its own as a large agricultural producer.

Mr. A. R. Morkel, Ceres.—The scheme long under consideration by Mr. Morkel for taking water from the Umwindi River for irrigating the rich lands on Ceres situated on the other side of the watershed looks like being accomplished at last. The most recent proposal is to erect the diversion weir lower down the river than originally proposed, and bring the water through the hill by means of a tunnel about 1,000 yards in length. Preliminary shafts and investigations as to the feasibility of the latter are now being carried out, and a decision will then be made as to which of the alternative schemes will be undertaken.

Irrigation Loans.—The money set aside by the Government for assisting approved schemes of irrigation has not yet all been taken up, although numerous applications for same are under consideration. It was rather late in the season when this became available, and too late for many schemes to be put in hand during 1922. There are many schemes proposed for construction during 1923, and a busy season is anticipated by the officers of the Irrigation Branch. Farmers desiring to avail themselves of loan funds for constructing irrigation works, should funds still be available, should make early application.

Water Court.—The first sitting of the Court is set down for the end of March, and the districts to receive attention will probably be Hartley, Salisbury and Mazoe.

Economic Conditions.—The serious economic conditions existing in the country to-day naturally somewhat deter any very large schemes being taken in hand. The difficulties of the disposal of produce at remunerative prices are often very considerable; and there is no question Rhodesia will require to make very strenuous efforts in establishing export markets for many of its products if any measure of real prosperity is to be attained.

Nineteenth Annual Poultry Conference

OF THE S.A. POULTRY ASSOCIATION.

This Conference was held in the City Hall, Capetown, on 8th January and three subsequent days. Fifty-four delegates from clubs and egg circles of South Africa were present, including only Bulawayo and Salisbury clubs from Rhodesia. Three Union Government poultry experts and the Rhodesian Government poultry expert were present.

The report of the Executive Board shows that the position of the S.A. Poultry Association is a very sound one. The number of affiliated clubs now totals 73, an increase of nine as compared with last year. A levy on export of eggs for the purpose of providing funds for the testing, grading, etc., of these has been instituted, and the balance (if any) over and above the expense of this is to be used for the furtherance of the poultry industry. A levy of 9d. per case is imposed, and the inspection fee is 3d. per case. Arrangements have been made for inclusion in a weekly cable by the Trades Commissioner in London of the latest information regarding the position and prices of eggs on the English market. During the year the rate imposed by the Union-Castle Company for carrying eggs has been reduced from 120s. to 90s., and it is to be trusted that it will be still further reduced to that for fruit, which is 40s. per ton. During the year most unsatisfactory reports on shipments of eggs to London were received, and a commission of enquiry was appointed, which reported that small, dirty and bad quality eggs were delivered by egg merchants for shipment and allowed to pass inspection. This has now been remedied, and very stringent regulations and more careful inspection will be made in future. Egg circles have during the year been discussed, but beyond the one in operation at the Cape not much progress has been noticeable.

A report of the Egg-laying Test Committee was received, in which it was noted that the number of underweight eggs was increasing; and lack of uniformity in the birds entered was remarked upon. A number of resolutions dealing with egg-laying tests were discussed at length. It was decided, after discussion, to commence the tests on 1st April, and in order to bring all in South Africa into uniformity, the Rhodesian test will accordingly be altered to that date. With regard to dry and wet mash, the Rhodesian poultry expert was most decidedly in favour of the former, and gave many reasons why this is preferable to wet mash. He also stated that from the commencement of the Rhodesian test dry mash only had been used, and that dry mash feeding throughout the country had practically replaced wet mash feeding. Better, stronger and more profitable stock, and a larger

quantity of eggs throughout the country, were attributed to this treatment.

The question of rates on eggs and poultry was discussed at length. The marking of eggs as foreign, cold storage or preserved found little support from those who have some connection with such eggs, and it is unfortunate that little headway was again made in this matter. It is certainly necessary, as has been recognised in England, America and Australia.

The eradication of vermin and disease was among the most important subjects on the agenda, and was freely discussed. The Rhodesian expert described the measures that have been and are being adopted in Rhodesia for such eradication, with very successful results, and strongly recommended similar ones being adopted in the Union. He also, when dealing with this matter, drew attention to the fact that it was time the mistake which had persisted now for so many years of confusing the tampan with the fowl tick should be once and for all rectified. He explained, with the help of illustrations and a bulletin (which he passed round), published in the *Rhodesia Agricultural Journal* two years ago, the difference between the two insects, the result being that the words "tampan or" were deleted from the resolution.

The matter of the importation of liquid eggs also received attention, and it was recommended that every facility should be given for the local manufacture of this product.

Standards were also dealt with, the most important being one for Utility Black Leghorns.

Resolutions dealing with judges and judging, show rules and rings, were also discussed.

It was decided to hold the next Conference at Johannesburg, and the next championship show at Capetown on 7th to 9th June.

It was further decided that a pedigree register for poultry be adopted, and a committee was appointed to approach the Government with reference to Government grants being again given to poultry clubs.

On the 10th the delegates were shown over the Imperial Cold Storage Works, and later the cold storage chambers of the "Kildonan Castle," where they were received and entertained to tea by Sir Owen Phillips. The delegates visited by invitation three poultry farms, viz., those of Mr. James, Messrs. Maspero, and Mr. Jagger, M.L.A. A visit was also paid to Elsenberg School of Agriculture.

Mr. Canham, the Trades Commissioner in London, was present and also addressed the Conference, and urged the delegates to endeavour to have the poultry industry fully represented at the Empire Exhibition next year in London.

After four days' strenuous and rapid work the Conference was brought to a conclusion with, it is to be hoped, future good results to the poultry industries of the Union and of Rhodesia.

Report of Southern Rhodesia Egg-Laying Test.

1ST APRIL, 1922, to 5TH JANUARY, 1923.

During the four weeks 88 birds were laying, and produced 1,146 eggs, an average per bird of 13.02 eggs; 24 of the heavy breed section have been laying, and have produced 313 eggs, an average per bird of 13.04 eggs; 64 of the light breed section have been laying, and have produced 833 eggs, an average per bird of 13.01 eggs.

The total weight of eggs in the four weeks was 151 lbs. 5 1-16 ozs. The maximum number of eggs laid on one day was 64 on the 10th December, and the minimum 18 on the 1st January. The average number of eggs laid per day was 40.93 eggs.

Of the trap-nested birds, the following laid:—

26 eggs—Pen 16, No. 77.

23 eggs—Pen 3, No. 13.

21 eggs—Pen 15, Nos. 73 and 75; pen 16, No. 76.

20 eggs—Pen 9, Nos. 41 and 44.

19 eggs—Pen 15, No. 71; pen 16, No. 78.

18 eggs—Pen 6, No. 29; pen 7, No. 31.

The weather during this period has been very hot, with a less number of rainy days as compared with the previous period. A number of the birds are moulting heavily, with an increased number of broodies, and in consequence the egg records show a decrease on last month's total, which is naturally to be expected at this season of the year.

Three birds have died during this period. Nos. 53 and 79, from pens 11 and 16 respectively, succumbed from the effects of peritonitis following a ruptured ovum, and bird No. 50, pen 10, died from the effects of an internal tumour. All have been replaced.

Broodiness.—The following hens have been broody and returned to their respective pens:—Two birds in each of pens 1 and 5, which are not trap-nested.

Light Breed Section—Nos. 42, 43 and 44 in pen 9; Nos. 47 and 49 in pen 10; Nos. 67 and 68 in pen 14.

Heavy Breed Section—Nos. 7 and 8 in pen 2; Nos. 11 and 14 in pen 3; Nos. 16, 18, 19 and 20 in pen 4; Nos. 28 and 29 in pen 6.

Moult.—So far there are 27 birds in the moult, three of which are still laying, namely, birds Nos. 26, 31 and 44, in pens 6, 7 and 9 respectively. The others are as follows:—Pen 2, bird No. 7; pen 10, birds Nos. 47, 48 and 49; pen 12, birds Nos. 56 and 57; pen 14, birds

Nos. 67 and 68; pen 17, birds Nos. 81, 84 and 85; pen 18, birds Nos. 87 and 90. Of those which are not trap-nested, there are three birds in each of pens 5, 11 and 13, and two each in pens Nos. 8 and 19.

Note.—Laying Test, 1923-24—The next test will commence on 1st April, 1923. Entries close on 14th February. Full particulars and entry forms can be obtained on application to the Poultry Expert, Department of Agriculture, Salisbury.

HINTS TO BREEDERS.

The season for poultry to moult is the present few months, and it is advisable to consider the best treatment during this trying time. The young stock do not feel the strain of changing feathers very much, but as the birds get older it tells on them. It will also be found that those birds which have been laying heavily require watching, as the drain on them during the laying season is very great, and if they do not get proper handling it may take months before the new feathers grow. Cases have been known of birds taking from January to August to grow new feathers, simply because, having become run down, the owner had not the knowledge to handle and care for them properly.

It is of great importance to get rid of all the insect vermin (at least as many as possible) on your stock and in the houses. To do this, select a nice warm day and either dip the birds or dust insect powder well under the feathers to the skin, taking care not to injure the young growing feathers. The houses should be well disinfected by spraying with a suitable insecticide and by whitewashing the interior of the houses. Should your birds not be getting into the moult as quickly as you think they should, you can help matters by still further reducing their rations, and on dry days medicate either the drinking water or soft food with Epsom salts.

Lavish feeding tends to prolong the moult, whereas, with reduced rations and proper attention afterwards, your birds will save time and come on to lay sooner.

It is just at this time that one's birds are apt to catch cold and very often contract roup and other diseases, as the fowls will not be in a fit state to stand much damp or draughts, and precautions should be taken to avoid such troubles from the outset by studying the comfort of the birds.

The young stock as they show signs of coming on to lay should be transferred from the rest to the laying quarters, which should be done before they commence laying, to allow them to settle down in their new quarters. The laying pullets will be found to be very profitable for the next few months, and every care should be given them, so that they will lay regularly and well, by providing them with nice clean houses and runs which are free from insect vermin. Supply also plenty of clean, dry litter, into which the grain food ought to be buried. The nest boxes should also be attended to; clean and whitewash them well, and after they have dried in the sun replace them, and provide fresh, clean nesting material. Attend to the grit and shell boxes, and supply abundance of green food daily.

THE THIRD SOUTHERN RHODESIA EGG-LAYING TEST.
FIVE BIRDS IN EACH PEN.

1ST APRIL, 1922, TO 2ND MARCH, 1923.

HEAVY BREED SECTION.

Pen No.	Position.	Owner.	Residence.	Breed.	Results from 1st April, 1922, to 5th January, 1923, inclusive.		
					Total No. of eggs.		Total weight of eggs.
					2 ozs. and over.	Under 2 ozs.	
1	2	Mrs. Watson	Glendale	Rhode Island Reds	586	69	77 lbs. 1 11-16 ozs.
2	3	Mrs. Bernard	Headlands	do.	538	100	72 lbs. 6 11-16 ozs.
3	4	T. A. Stokes	Salisbury	White Wyandottes	514	18	67 lbs. 6 5-16 ozs.
4	6	Mrs. Cheesman	Unvuma	Rhode Island Reds	401	109	12 lbs. 1 5-16 ozs.
5	1	Mrs. Colborne	Banket	Black Opingtons	714	33	12 lbs. 14 3-16 ozs.
6	5	Mrs. Skillen	Salisbury	Rhode Island Reds	499	6	3 lbs. 14 3-16 ozs.
				Totals	3,252	385	67 lbs. 1 8-16 ozs.
							39 lbs. 1 14-16 ozs.

LIGHT BREED SECTION.

7	5	Mrs. Hatton	Unvuma	White Leghorns	608	59	80 lbs. 10 11-16 ozs.
8	4	Mrs. Graham	Avondale	do.	604	14	6 lbs. 13 12-16 ozs.
9	10	Mrs. Hunter	Glendale	do.	518	81	1 lb. 10 9-16 ozs.
10	9	Mrs. Colborne	Banket	do.	545	229	9 lbs. 5 14-16 ozs.
11	11	Mrs. Watson	Glendale	do.	508	172	26 lbs. 9 1-16 ozs.
12	7	J. Knighton	Bulawayo	do.	558	77	19 lbs. 6 ozs.
13	13	J. Cook	Cape Town	do.	450	143	8 lbs. 13 6-16 ozs.
14	3	Weymouth P. Fm.	Bulawayo	do.	651	114	16 lbs. 3 9-16 ozs.
15	1	Mrs. Michell	Salisbury	do.	800	31	13 lbs. 4 15-16 ozs.
16	8	E. C. Holmes	Bindura	do.	583	162	3 lbs. 8 14-16 ozs.
17	12	Miss Greig	Bulawayo	do.	447	199	18 lbs. 11 10-16 ozs.
18	14	Mrs. Matheson	Gatooma	do.	423	161	22 lbs. 7 5-16 ozs.
19	6	Mrs. Russell	Que Que	do.	611	145	18 lbs. 11 5-16 ozs.
20	2	Golden Grove P. Fm.	Rondebosch	do.	648	97	18 lbs. 13 ozs.
							11 lbs. 5 2-16 ozs.
				Totals	7,954	1,704	195 lbs. 14 6-16 ozs.
				Grand totals of both sections	11,206	2,039	235 lbs. 0 4-16 oz.

Total number of eggs for 40 weeks, 13,245 ; total weight, 1,711 lbs. 5 9-16 ozs.

Seed and Plant Distribution, 1919-22.

By J. A. T. WALTERS, B.A., Agriculturist.

The free distribution of seeds and plants of new crops or of new varieties of old crops is one of the most important activities of the Agriculturists' branch of this Department. The object of these free grants is the extension of the experimental work conducted at the Salisbury and Gwebi Farms to the varying conditions found on farms throughout the Territory. As a rule only sufficient seed of any variety is available to enable the individual farmer to grow about $\frac{1}{4}$ acre of the crop. But from this source, if successful, sufficient seed is obtainable to sow a considerable area the following season.

It is gratifying to note that the desire to experiment is a very marked trait of the farming community in this Territory, and the extent to which farmers avail themselves of this service may be gauged from the figures given below. It is by this means more than by any other that the results achieved in experimental work can be communicated to farmers in every district of the Territory, and the waste, both of time and money, involved in trying crops that are not likely to be successful under Rhodesian conditions can be avoided.

Applications for seeds as a rule far exceed the supply available, and it frequently happens that early applicants alone can be supplied. A notice giving the varieties and quantities that can be distributed appears in the August and October issues of the *Rhodesia Agricultural Journal* each year. But, although free distribution nominally closes on the 31st October, attempts are made to meet later demands, should seasonal or other causes require it. The work involved in such distribution is very considerable. Not only do the cuttings, rooted plants and other perishable articles need to be packed with extreme care, but notices and rail notes are sent to each individual, so as to ensure as far as possible prompt delivery and receipt by the applicant. Later on report forms are issued, on which a report on the behaviour of each crop on his own farm is asked of each recipient. This is the only condition attached to this free distribution of seed, and it cannot be too strongly emphasised that it is on the care and accuracy with which these forms are filled up that the whole value of the scheme depends. When these forms have been received at the close of a season, they are tabulated and correlated to the peculiar conditions of the season and district and conclusions are drawn. It may happen that unfavourable or inaccurate reports may delay the introduction of a particular plant to a locality for years.

In the case of Napier fodder, this plant has now been so universally established that few applications for free issues are received. Of recent introductions, the Kudzu vine has been most in demand, followed by beggar weed and velvet beans. This would seem to indicate that farmers are realising the dearth of natural legumes in this country, and are endeavouring to remedy it by growing the above importations. The sweet potato is gradually obtaining the recognition it rightly deserves, and the figures given do not include the issues now being made. The total number of issues of grasses for pasture purposes amount to 344, the Kikuyu, tussock, molasses and African star grasses being the most in demand.

Total number of free issues, 1919-22=2,247.

The principal items in this total are the following:—

Wheat	...	...	...	233	issues.
Kudzu vine	...	...	...	213	„
Oats	...	...	...	152	„
Beggar weed	...	...	...	139	„
Velvet beans	...	...	...	125	„
Sweet potatoes	...	...	...	110	„
Rice	...	...	...	98	„
Kikuyu	...	...	...	81	„
Sunflowers	...	...	...	73	„
Linseed	...	...	...	68	„
Ground nuts	...	...	...	62	„
Sunn hemp	...	...	...	59	„
Tussock grass	...	...	...	50	„
Molasses grass	...	...	...	45	„
Barley	...	...	...	42	„
Buckwheat	...	...	...	38	„
Dhal	...	...	...	35	„
African star grass	...	...	...	30	„
Napier fodder	...	...	...	23	„
86 other varieties of seed	...	...	...	571	„

SOUTHERN RHODESIA.

Report of the Committee of Enquiry in respect of African Coast Fever.

TO HIS HONOUR THE ACTING ADMINISTRATOR.

As soon as possible after the appointment of the Committee, arrangements were made to visit such places as might be convenient to those persons likely to give useful information. Advice of the meetings was sent to all associations and bodies likely to be interested and also to certain individuals more directly concerned, in addition to notices appearing in the Press. Enkeldoorn, the Wiltshire Estate and Southern Marandellas were visited and all available evidence taken, the number of witnesses examined being forty-four, of whom eleven were natives.

The views of the Committee are as follows:—

1. *The origin and circumstances attending the recent outbreak of African Coast Fever at the Wiltshire Estate and certain other farms in the Charter and Chilimanzi districts.*

The Committee is satisfied that African Coast Fever broke out first on the Wiltshire Estate and that all other outbreaks were due to infection carried therefrom.

As to the origin of the main outbreak, two theories were advanced in the course of the enquiry:

- (a) that infection was brought by cattle travelling on foot from the infected area in the Melsetter district; and
- (b) that it was carried by cattle acquired from farms south of Bulawayo in the early part of 1921.

The Committee was unable to accept either of these theories as established by the evidence.

The distance from the nearest point where infection is known in the Melsetter district, roughly 150 miles, is so great that any direct movement of cattle to the Wiltshire Estate must have taken a considerable time. The Sabi Reserve, through which such movement would have taken place, is an area exempt from the Cattle Cleansing Ordinance. It is morally certain that, had the disease been introduced in that manner, there would have been outbreaks along the route, whereas none have occurred. Save for one case, to be referred to later and

accounted for as traceable to another cause, the whole Sabi Reserve has remained free from disease.

As for the suggestion that cattle were brought from Bulalima-Mangwe and Matobo districts in February and April, 1921, these cattle came from farms which have been free from disease. The technical evidence is against this theory, as it is extremely improbable that the disease could have existed on the estate for over twelve months without detection.

No evidence has been forthcoming to establish a satisfactory explanation of the cause of the outbreak, and the Committee therefore regrets that it is unable to give anything in the nature of a definite opinion on that point.

As to the circumstances attending the outbreak on the Wiltshire Estate, the facts found are as follows:—The mortality among the cattle on the estate up to the end of April was not above the normal average. There had been several deaths attributed to gall sickness and quarter evil. These two diseases actually existed on the estate, but from the light of subsequent events it cannot be doubted that the diagnosis of some of these cases was incorrect and that African Coast Fever was the real cause. It is impossible to say when the first deaths from that cause occurred. It might be mentioned here that statements have been made by various natives to the effect that a large number of deaths from disease occurred daily on the estate for several months before the outbreak was reported.

The Committee investigated these statements as carefully as possible and came to the conclusion that the evidence to that effect was entirely unreliable.

At the beginning of May the mortality increased suddenly to an alarming extent, and the Veterinary Department was called in, Coast Fever diagnosed and steps taken to control the outbreak. The infection then existed among many different mobs of cattle, but that is accounted for by the fact that about 5,000 head of cattle were dipped at two tanks.

Other outbreaks occurred on the farms Swartfontein, adjoining Enkeldoorn Commonage; Mooifontein, east of Umvuma, and Chipisa, south-east of Enkeldoorn; also on Enkeldoorn Commonage and the Sabi Reserve.

The first four of these are related inasmuch as they followed on the movement of certain oxen which had been working on the Wiltshire Estate in connection with fencing operations. These oxen left the estate on the 24th March, 1922, and proceeded to Swartfontein. After remaining there about four weeks, one span was taken to Mooifontein.

Deaths were reported from these two farms on the 20th May and the presence of the disease discovered.

On the 3rd June an ox died from Coast Fever at Chipisa. This ox was one of a span which had been to Swartfontein about three weeks earlier and doubtless became infected there.

On the 1st August a beast died on Enkeldoorn Commonage. This case was traced to the breaking through the fence of certain cattle on to Swartfontein.

One death occurred in the Sabi Reserve on the 13th August. The infection was attributed to cattle which had been on the Wiltshire Estate and later were found on the Sabi Reserve without authority and destroyed.

2. The adequacy or otherwise of the measures taken to prevent the spread of the disease.

From the moment that the outbreak was known to the Veterinary Department the utmost expedition was used in coping with it.

Cordons were established round the infected areas, movements of cattle stopped, three days' dipping ordered where tanks were available, and officials stationed at the various infected farms to see that the instructions were duly carried out. The Department was fortunate in having the services of a pathologist (with previous experience of the disease) available for special duty on the spot, and every death was enquired into with despatch.

The following figures give the mortality from African Coast Fever to the 22nd November:—

Outbreak.	Number of Deaths.	Number of Cattle.	Percentage.
Wiltshire Estate	1,046	5,066	20
Swartfontein	86	188	46
Mooifontein	10	355	3
Chipisa	38	74	51
Sabi Reserve	1	...	...
Enkeldoorn Commonage ...	1	...	...

The last death was on the 18th October, one other death occurring during the month.

In comparing the above figures, it is interesting to note that on Swartfontein and Chipisa, where there were no dipping tanks, the cattle of necessity remained undipped for four or five weeks, until the erection of tanks, whereas a tank was available on Mooifontein and three days' dipping enforced at once.

The Committee is satisfied with the adequacy of the methods used in controlling the disease. With the exception of certain criticisms made on behalf of farmers near the northern borders of the Wiltshire Estate, the evidence of those directly concerned was wholly to the effect that the responsible officials have dealt vigilantly, strictly and effectively with the outbreaks, without failing in consideration of individual interests so far as it could be done with safety.

Of the criticisms referred to, it is only necessary to mention two in this report.

Some time after the outbreak on the Wiltshire Estate it became necessary to remove cattle from the heavily infected sections of the estate to other ground for two reasons, viz.: as a necessary step towards

the eradication of the disease, and for pasturage for the cattle. This movement was to the northern sections of the estate, but it was delayed until the northern boundary was fenced. The losses from poverty on the estate since the outbreak total over 1,300.

It was strongly urged that this movement should not have been allowed and that the cattle should have been moved to other portions of the estate instead, leaving an area along the border free of cattle.

The Committee is of opinion that the movement was in order. The management had the approval of the responsible authorities, and this approval was only given after due consideration of the position.

The other action which occasioned dissatisfaction was in connection with a wagon and span of oxen moved to Marshbrook Farm from Inyanga *via* Maraudellas. Though the owner had permits, these permits should not have been given by the issuers. The owner of Marshbrook and adjoining farms was not agreeable to the cattle remaining there; no good reason existed for their destruction, as there was no question of their having been on infected ground; therefore their removal was ordered and they were isolated on farms outside the guard area. It is difficult to see what else could have been done.

3. *The manner in which the "Cattle Cleansing Ordinance, 1918," was carried out in the aforesaid districts.*

(a) CHARTER DISTRICT.—The Cattle Cleansing Ordinance does not appear to have been strictly enforced prior to the outbreak. It would have been a difficult matter, indeed, to have enforced regular dipping with the number of dipping tanks that were available. In May, 1921, there were only 26 tanks; the number had increased to 38 at the time of the outbreak. At the present moment 49 new tanks are either complete or in the course of erection.

Even where tanks were available it does not appear that dipping was as regular as it should have been.

(b) CHILIMANZI DISTRICT.—Dipping appears to have been reasonably regular in this district. There are no exempted areas and the district is well provided with dipping tanks. In May, 1921, there were 81 and at present there are 95.

A. E. SPEIGHT, Chairman,

J. A. EDMONDS,

J. STRUTHERS,

Members of Committee.

Salisbury,

12th December, 1922.

Report of Settlers' Board.

The following are extracts from the report submitted to the Southern Rhodesia Settlers' Board by the President:—

“ President, Mr. B. I. Collings; Members, Dr. Eric Nobbs, Ph.D., B.Sc. (Director of Agriculture), Messrs. L. Cripps, M.L.C., J. B. Macdonald, M.L.C., John Pascoe, G. V. van der Byl, Duncan Black, H. G. Mundy, F.L.S., H. W. Taylor, B.Agr., C. F. Browning, O. C. Rawson, T. C. Deas, W. M. Simpson, G. A. Simpson, D'Urban Webb and Lieut.-Col. Lovell Haslam, with Messrs. P. H. Gresson and C. C. Townsend as representatives of the Rhodesia Agricultural Union.

“ Local Advisory Committees are now established in 36 centres throughout the country. They are composed in all cases of persons who are well known to the Board, and who are in sympathy with its objects. The services of these committeemen have been given freely whenever called upon, and I would take this opportunity of expressing the Board's appreciation of the continued support accorded not only by these committees, but by the farming community generally. Owing to this co-operation it has always been found possible to arrange for the reception and tuition of prospective settlers most expeditiously and satisfactorily, and to forward a correct monthly report of agricultural conditions to the London office.

“ It will be recognised that in view of the unsettled constitutional conditions which have obtained in this country during the last year, and which still obtain, and in view also of the existing commercial and agricultural depression, it has been practically impossible to attract settlers with capital to the extent which is to be desired. Moreover, the funds at the Board's disposal for the purpose of advertising the country are very limited in comparison with the sums expended on similar objects by others of His Majesty's Dominions. It was, however, recognised at the beginning of the year under review that if the Board's efforts resulted in nothing more than keeping Southern Rhodesia in the eyes of what one may call ‘the migrating population of the Empire’ those efforts would be worth while. This object at least has been accomplished. The advertising and propaganda schemes have been altered and amended from time to time throughout the year in accordance with circumstances and in order to ensure the best possible results for the money expended. In this connection the Secretary has lately undertaken a journey to Durban, Delagoa Bay and Beira for the purpose of finding out the best means of bringing Southern Rhodesia to the notice of persons arriving in South Africa from Egypt, India, the Malay States, Ceylon and the East generally.

"Some 3,000 copies of the Board's pamphlet, 'Notes for Prospective Settlers' have been distributed during the year, and more are now urgently asked for by the various agents and helpers.

"During the year steps have been taken with a view to considerably amplifying the information contained in the literature issued by the Board. Most of the material is now to hand, and the work is about to be proceeded with. The Board's thanks are due to all those members of the agricultural, professional and farming community who have co-operated with them in this matter.

"The plots on the Woodville Estate, near Bulawayo, which were placed in the hands of the Board for settlement, have been satisfactorily dealt with except one 100-acre plot, which is still vacant, but for which an application has been received. On the recommendation of the Board the Administration increased the time over which the payment of purchase price from ex-soldiers is spread from 10 to 11 years, and in order to assist the tenants over the last very bad season only demanded interest on the instalment of purchase price payable in 1922.

"The Board has in mind that the British Empire Exhibition takes place in 1924. It has, however, been impossible up to the present, for financial reasons, to make any proposal in regard to Southern Rhodesia taking part in it. It will be unfortunate if we are unrepresented.

"The Board has devoted a great deal of time during the year to enquiries into the advisability of settlers with limited means renting land with or without the option of purchase in preference to purchasing land. It would appear that in many cases where the settler's means are limited strictly to the minimum of £2,500 it would be wiser for him to rent land for a term of years rather than to deplete his funds by paying away a large proportion in the form of instalments for purchase price. Again, in those cases in which the settler is doubtful of the suitability of the life either to himself or his family the system of renting provides a means of thoroughly testing the proposition before definitely committing himself. The Board is convinced that the time has arrived when in many cases settlers will be wise to adopt the principle of less land more intensively cultivated in lieu of the usual 3,000 or 6,000 acre farm.

"As a result of the Board's enquiries, it is now able to offer many farms and sub-divisions of farms of various suitable areas either for rent with or without the option of purchase or to purchase outright, and it is therefore in a position to cater for practically all enquirers for land, even when the applicants have rather less capital than the minimum amount of £2,500 which is recommended. Various suggestions have been put before the Board with a view to inducing the larger landowners to offer some scheme of assisted settlement in which the owner would retain an interest and act as senior partner. As the outcome of discussion on this subject the Board is of opinion that except in the case of a Government scheme the only possible feasible plan, apart from the straightforward purchase of land, is (a) the

settler to acquire sufficient knowledge of local methods to enable him to manage for himself before taking up land; (b) to rent land on exactly the same system as obtains in Europe, viz., leasing everything that is supplied by the landlord, whether it be cattle, implements, land or improvements; and (c) to retain full and sole control in his own hands, subject only to the provisions of the lease. In spite of the fact that the Board recommends its adoption in certain cases, this question of renting land is not without difficulties. In older European countries the agreement between the landlord and tenant of an agricultural holding is governed by well-established custom, or as in England and Scotland, for instance, by Agricultural Holdings Acts. In this country, of course, no established custom or corresponding Acts exist. The landowner is often unwilling to give the tenant terms which will encourage him to do the best with the land he is occupying, or to ensure him against loss in connection with improvements or acts of husbandry, the residuary benefits of which ultimately accrue to the landlord. Similarly, from the landlord's point of view, some recognised system of protection for the land against bad husbandry on the part of the tenant is required.

"The Colonial Office has been approached through the medium of His Honour the Administrator with a view to obtaining a grant-in-aid to the extent of £4,000 per annum (*i.e.*, £1 for £1 in accordance with the amount now actually spent on settlement apart from advertisements) under the recently passed Empire Settlement Act. In a letter, dated 6th December, from the London Office of the British South Africa Company, enclosing a copy of a letter from the Under Secretary of State, the Board is informed that the Colonial Secretary has no objection to the question being discussed being discussed by the Board of the British South Africa Company and the Overseas Settlement Office, although in the present constitutional conditions of Southern Rhodesia he is doubtful how far a scheme for promoting British settlement in Southern Rhodesia would be practicable. The Secretary of the British South Africa Company states that the question will be further discussed on the arrival of His Honour Sir Drummond Chaplin in England. The Board feels that with the assistance of such a grant as is asked for 50 or 60 settlers per annum, whose capital is less than the amount considered necessary for the taking up of land, could be enabled to establish themselves as self-supporting citizens in this country.

"The total number of enquiries received during the year, all of which have been fully dealt with, amount to 639. They are made up as follows:—

From persons apparently able to take up land ...	497
From persons seeking employment	142

"The countries of origin are:—

Great Britain	116
Union of South Africa	186
India and Malay States	206
Persons already in Southern Rhodesia	131

"The above resulted in 123 persons, of whom 32 were seeking employment, calling at this office and accepting the advice and assistance of the Board. Their countries of origin are:—

Great Britain	70
Union of South Africa	19
India and Malay States	9
Already in Southern Rhodesia	25

"These were dealt with as under:—

Placed on farms for tuition	51
Settled on the land (including 12 of the above) ...	28
Placed in employment	19
Assisted to travel about and learn local conditions	17

"The average capital possessed by settlers is £2,775. A conservative estimate of the immediate financial result of the year's work (taking into account only 67 persons who are undergoing tuition or who have already taken up land) is that for an expenditure of £5,143, capital to the amount of £185,625 has been brought into the country.

"The total number of persons settled, or in the way of being settled, as self-supporting citizens is 86. The cost per head to the country of these 86 persons, exclusive of the £900 spent on advertisements (the return from which cannot yet be reckoned) is approximately £50. Although, therefore, the volume of business has been small owing to circumstances already referred to, the Board's balance-sheet presents a satisfactory state of affairs.

"Great credit is due to the Secretary and his staff for their energy and initiative in building up an organisation, with branches throughout the country, which is proving very necessary in enabling new comers to satisfactorily settle themselves with the least possible delay and expense.

"With the much larger influx of new settlers that may reasonably be expected under a more settled form of government, this organisation, now practically complete, can but be extremely useful."

Southern Rhodesia Veterinary Report.

October, 1922.

AFRICAN COAST FEVER.

MELSETTER DISTRICT.—At the Merino centre of infection 27 deaths occurred.

CHARTER DISTRICT.—The mortality was 6 head, viz.: 4 at Mooifontein and 2 at the Wiltshire Estate.

CONTAGIOUS ABORTION OF CATTLE.

Centres of infection previously unknown were reported from the Marandellas, Mazoe and Gwanda districts.

TRYPANOSOMIASIS.

Two head of cattle died on the farm Sterling in the Melsetter district, and 6 oxen near Robb's Drift in the Hartley district.

HORSE-SICKNESS.

Two horses died in Salisbury district and 1 in Insiza district.

SENKOBO (SKIN DISEASE OF CATTLE).

Five cases reported from the Nyamandhlovu district.

IMPORTATIONS.

From the Union of South Africa:—Bulls 64, heifers 23, horses 31, mules 12, donkeys 86, sheep 1,260, goats 315. From Portuguese East Africa:—Donkeys 2.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle 1,248, breeding cattle 197, horses 3, pigs 60. To Northern Rhodesia:—Horses 3, sheep 65. To Congo:—Cattle 948, sheep 65. To Portuguese East Africa:—Oxen 36, donkeys 14.

November, 1922.

AFRICAN COAST FEVER.

The position generally showed a marked improvement, the total mortality at the various infected centres being 8 head only, viz.: 6 at Merino, Melssetter district, and 1 each at Swartfontein and Mooifontein, Charter district.

CONTAGIOUS ABORTION OF CATTLE.

One centre of infection previously unknown was reported from the Marandellas district.

HORSE-SICKNESS.

The following mortality was reported:—Victoria 1, Gwanda 3, Shabani 1, Insiza 1, Nyamandhlovu 1, Wankie 3, Shamva 1.

TRYPANOSOMIASIS.

Eight head of cattle died in the Hartley district.

ANTHRAX.

An outbreak occurred on a farm in the Shamva section of the Mazoe district; 15 head of cattle died, and the remainder were vaccinated.

IMPORTATIONS.

From Great Britain:—Bulls 7, heifers 3, pigs 7. From Union of South Africa:—Bulls 1, heifers 3, horses 15, donkeys 81, sheep 1,092, goats 525. From Northern Rhodesia:—Horses 1, mules 4. From Portuguese East Africa:—Donkeys 4.

EXPORTATIONS.

To Union of South Africa:—Breeding cattle 279, slaughter cattle 1,958, horses 1. To Northern Rhodesia:—Horses 4, sheep 65. To Congo:—Bulls 14, cows 2, heifers 186, oxen 167. To Portuguese East Africa:—Sheep 65.

December, 1922.

AFRICAN COAST FEVER.

No deaths at any of the existing centres of infection.

CONTAGIOUS ABORTION OF CATTLE.

Centres of infection previously unknown were reported from the Mazoe and Matobo districts.

ANTHRAX.

With reference to the outbreak in the Shamva section of the Mazoe district recorded in last month's report, the total mortality was three head, not fifteen as therein stated.

HORSE SICKNESS.

The following mortality was reported:—Gwelo, 2 horses; Gwanda, 2 horses; Victoria, 2 horses; Nyamandhlovu, 1 horse.

EPHEMERAL FEVER

(Three-day sickness of cattle).

A few cases reported from the Ndanga and Gwanda districts.

SWEATING SICKNESS OF CALVES.

A few cases occurred in the Salisbury and adjoining districts, Bulawayo and Insiza districts.

IMPORTATIONS.

From Great Britain:—Bull, 1. From Union of South Africa:—Bulls, 3; heifers, 27; horses, 31; mules, 32; donkeys, 98; sheep, 1,080; goats, 470.

EXPORTATIONS.

To Union of South Africa:—Slaughter cattle, 1,034; breeding cattle, 773. To Belgian Congo:—Slaughter cattle, 1,016; breeding cattle, 132; sheep and goats, 110. To Portuguese East Africa:—Breeding cattle, 216; oxen, 72; bulls, 3; horses, 3; donkeys, 32; sheep, 130.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

Agricultural Outlook.

So far the season has been ideal for the growing of almost every kind of crop. The meteorological returns show that good steady showers are general all over the country. There are, however, isolated cases where little rain fell for some time after the new year, but such cases are happily rare. A factor which is unfavourable to growth is the occasional cold period following on rain. Cold weather does not promote that vigorous growth noticeable in moist warm weather. The rainfall to date (29th) has passed the 20-inch mark, which is about 3 inches above normal for Salisbury. Reports from several other centres also indicate that the normal rainfall has been passed. The eastern portion of the Gwelo district and the western half of the Charter district, however, which lie in the exact centre of the Territory, are receiving very little rain, and the crops in that area are more backward than elsewhere. The early planted maize is in flower, and the late planted mealies, though still on the small side, are growing rapidly. If the season continues in its present form, a record maize crop is assured. With the recent reductions in both rail and shipping rates on maize, the position promises to be a brighter one for growers of the crop. Tobacco crops in various parts of the country are reported to be affected with the diseases known as "wild-fire" and "angular spot." In a few cases these diseases appeared suddenly, evidently stimulated by the recent damp weather. All growers are advised to examine carefully their plants, and upon detecting any signs of either of the above diseases to take early and adequate steps to cope with the infection by burning the affected leaves if the disease is in the early stages, and by burning the entire plant if it is advanced.

Silos should now be prepared for ensilage. Opportunity should be taken at the first spell of dry weather to cut veld hay, which is now seeding and at its best for this purpose.

Early ploughing for winter crops should be taken in hand as soon as the weather permits during the next two months.

RHODESIAN MILK RECORDS TO DATE.

Name of cow.	Breed.	Commenced record.	Milk in lbs. Latest return.	Butter fat in lbs. Latest return.	Milk in lbs. to date.	Butter fat in lbs. to date.	Time from commencement of record.	Name and address of owner.
Pansy IV. ...	Frieslaud	6/5/22	734	...	5,438	...	224 days	C. F. Anthony, Gwelo.
Ringte Emma ...	do	26/8/22	761	...	2,480	...	112 do	do
Begonia ...	do	19/9/22	1,453.8	49.43	6,601.1	224.45	120 do	J. A. Baxter, Victoria Street, Sby.
Banjo ...	Shorthorn	9/8/22	425.6	17.62	2,258.5	80.43	140 do	C. G. T. Cooper, Essenvale.
Betta ...	do	do	418.3	18.20	2,280.3	92.36	140 do	do
Fourbob ...	do	16/8/22	393.4	19.24	1,968.4	88.68	133 do	do
Baby ...	do	4/10/22	434.7	22.30	1,254.4	55.15	84 do	do
Pepper ...	do	1/11/22	436.1	23.72	1,258.2	41.87	56 do	do
Zaza ...	do	8/11/22	462.7	27.58	796.6	43.87	49 do	do
N'Genga ...	do	15/11/22	501.2	28.40	746.2	38.10	42 do	do
Emily ...	do	29/11/22	425.6	18.43	425.6	18.43	28 do	do
Dolly ...	do	do	348.2	14.45	348.2	14.45	28 do	do
Aggie ...	Cape cow	3/9/22	532	23.41	2,212	90.15	112 do	Knight & Folkestad, Lochinvar, Sby.
Peggy ...	do	do	658	32.90	2,324	109.93	112 do	do
Daisy ...	Friesland	do	630	27.72	2,429	95.83	112 do	do
Joan *	Shorthorn	do	665	32.58	2,310	105.56	112 do	do
Henrietta *	do	24/11/22	280	...	280	...	28 do	R. C. MacLagan, Ransape.
Spotlie *	Ayrshire	do	210	...	210	...	28 do	do
Agnes *	do	1/12/22	192.5	...	192.5	...	21 do	do

* These cows are suckling their calves.

RHODESIAN MILK RECORDS - *continued*.

Name of cow.	Breed.	Commenced record.	Milk in lbs. Latest return.	Butter fat in lbs. Latest return.	Milk in lbs. to date.	Butter fat in lbs. to date.	Time from commencement of record.	Name and address of owner.
Red Rose*	Shorthorn	24/11/22	259	...	259	...	28 days	R. C. MacLagan, Rusape.
Daisy*	Friesland	16/10/22	609	...	1,582	...	70 do	F. E. Pickering, Fairview, Sinoia.
Stenhouse*	do	17/9/22	511	...	1,519	...	84 do	do
Cherry*	do	20/10/22	559	...	804	...	56 do	do
Peach*	do	27/11/22	735	...	889	...	35 do	do
Bella ...	do	24/12/22	567	...	1,099	...	66 do	do
Maureen	do	13/8/22	531	16.99	1,831	68.36	105 do	J. S. Struthers, Palm Tree, Sinoia
Rosebud	do	17/9/22	339	14.23	927	37.75	70 do	do
Bell ...	do	8/10/22	669	22.74	1,163	42.50	49 do	do

* These cows are suckling their calves.

N.B.—A gallon of milk weighs approximately 10 lbs.

Farming Calendar.

February.

BEE-KEEPING.

In some districts a second flow of honey may be looked for from the veld flowers and late growing crops. Honey being secured in either sections or shallow frames should not be permitted to remain too long on the hive at this time of year, as it will become soiled with the bees' feet. Robbers may be anticipated, and this is a sign that the honey flow is nearly over. Where stocks are short of food, feed rapidly inside the hive; excellent feeders can be supplied by appliance dealers. Queenless stocks can now be re-queened, or two stocks can readily be united by previously dusting each lot with household flour. Grade and dispose of honey.

CITRUS FRUITS.

The notes on planting still apply, if trees are still planted this month, an operation which, however, it is not desirable to leave so late. Trees planted after about the end of January may only get established when it is too late that season for them to commence growth, the consequence being that what growth there is still sappy at the approach of the cold weather and so stands a chance of being nipped. In such case the tree would have been better left in the nursery row to be lifted and transplanted into the orchard the following spring.

By the end of February or early March the cover crop should be ready to plough into the orchard, with the possibility of sufficient rains after it is done to assist in rotting the plants in the soil. A continuous watch should be kept for insect pests, and fumigation or spraying undertaken immediately any pest is observed. If no cover crop has been sown, the orchard should be kept in a good state of cultivation, and not allowed to be overrun with grass and weeds. Destroy all fruit infested with citrus codling moth by burning or burying deeply. Do not allow the fruit to fall to the ground before destroying it, but pick all affected fruit as soon as it is observed. Considerable damage is done in some orchards by citrus codling moth, which can be controlled to some extent by using a poisoned bait made up as follows:

Arsenate of lead (paste), 2 lbs. or 3 ozs.
Arsenate of lead (powder), 1 lb. or 1½ ozs.
Treacle, 4 galls. or ½ gall.
Or sugar (cheapest), 40 lbs. or 4 lbs.
Water, 40 galls. or 4 galls.

Apply lightly in a coarse spray, getting a few large drops here and there throughout trees. Apply from beginning of the year until about early April every fortnight, and more frequently if rains wash off bait.

CROPS.

During the month the farmer's energies will be concentrated on keeping the lands thoroughly clean. A special campaign should be waged against such weeds as Mexican marigold before the seed heads are formed. Hay-making should commence this month, if weather conditions allow. The earlier the grass is cut during the month, the better quality of hay is

obtained. Commence ploughing virgin land that is intended for maize next season. Get the land ready for autumn-sown oats.

Sow now—Potatoes for main crop, peas (Black-eyed Susan), leff grass, buckwheat, linseed and haricot beans. Plant out Napier fodder and grass roots, also Kudzu vine.

DAIRYING.

This is the flush season so far as dairy produce is concerned. If cream is to be sent to the creamery, adjust the separator so that a cream of from 40 to 50 per cent. butter-fat content is obtained. This is usually got when the cream drops vertically from the cream outlet. If this vertical fall is not obtained, adjust the cream screw until the desired result is attained. As there is a greater strain than usual on the mechanism of the separator during the rush months, see that the separator is mounted dead level and that a good quality oil only is used.

When butter is made on the farm, put the cream and the washing water out overnight. By this means the temperature of both the cream and the washing water is reduced to 65 degrees or thereabouts. If the cream is well thinned with weak brine, a good grain can be obtained when the cream is churned before daybreak. Unless the butter is churned into the granular condition and is well washed, it will not keep.

The cheese in the store room during wet weather is apt to develop mould. If the cheese is well made and pressed and has a smooth rind, this mould is merely superficial and will not penetrate into the body of the cheese. Rubbing the cheese with a cloth moistened with a weak solution of formalin usually checks the mould, but the development of mould on the exterior of the cheese cannot be regarded as a serious fault, as it comes off when the bandage is removed. During these months care must be taken not to use over-acid milk for cheese-making. If this is used, a hard dry cheese will result. Great care should be taken of the starter. If any gassiness is developed, the starter must be discarded. The cheese store-room must be kept dark and flies excluded.

DECIDUOUS FRUITS.

This is the time to carry out summer pruning, after harvesting the crop, and when the flow of sap begins to become sluggish.

ENTOMOLOGICAL.

Maize.—The first brood of the stalk borer matures this month, and the young of the second brood may be found amongst the younger leaves. Weeds should be kept down (see March). Certain caterpillars are sometimes troublesome. See "Some Insect Pests of Maize," *Agricultural Journal*, June, 1912, "Some Injurious Caterpillars," *Agricultural Journal*, February, 1915, and "The Maize Stalk Borer," *Agricultural Journal*, December, 1917.

Tobacco.—Stem borer, leaf miner and budworms are the chief pests likely to be troublesome. See *Agricultural Journal*, December, 1919, and February, 1920.

Potato.—Ladybirds and tuber moth may call for attention; the latter, when very bad, sometimes causes considerable wilting of the crop besides attacking the tubers. See *Agricultural Journal*, October, 1913, and February, 1910.

Cabbage Family.—All members of the family are liable to the attack of sawfly and webworm during February. See *Agricultural Journal*, February, 1914; April, 1910; and April, 1911. The sawfly may be effectively controlled by dusting during a dry spell with Paris green and slaked lime. See *Agricultural Journal*, 1918.

Beans and Cowpeas.—These suffer chiefly from stem maggot and blister beetles, which destroy the blossoms. The latter must be collected by hand. The former is dealt with in the number of this *Journal* for April, 1913.

Melon Family.—The most important pest is the melon fly, which

"stings" the fruit of all species of gourds. At present no remedy is known except collecting and destroying the infested fruit early in the season. Aphis on the leaves and shoots may be destroyed by careful spraying with tobacco and soap wash or paraffin emulsion.

Mangolds and Beets.—These are frequently defoliated by caterpillars. Spray with an arsenical wash.

Citrus Trees.—The chief pest requiring attention during February is citrus codling. The infested fruit should be gathered and destroyed regularly. The fruit is also apt to be attacked by large fruit-piercing moths, for which unfortunately no remedy is known. For these and other pests see *Agricultural Journal*, February, 1916.

Deciduous Trees.—Apple, pear and late peaches suffer chiefly from fruit moths which puncture the fruit. No remedy is known except netting the trees.

Fig.—The fruit is liable to the attack of fig weevil. Infested fruit and all wild figs near the trees should be collected and destroyed. The borer in the stem may be killed by inserting a little carbon disulphide into the burrow and sealing it up.

Castor Oil.—Two-year-old plants which contain borer should be cut down and burnt. See *Agricultural Journal*, October, 1912.

Mosquitoes, House Flies, Stable Flies.—Destroy all breeding places round the homestead. Poison or trap adults. See *Agricultural Journal*, June, 1915, and December, 1916.

FLOWER GARDEN.

Sow carnations, phlox, pansy, verbena, gillias, larkspur, dianthus and pentstemon. The flower garden should be now looking its best, nearly all plants being in bloom. Old and dead flowers should be constantly removed, excepting when the seed is required. Seeding of the plants shortens their flowering period. All runners and climbers should have constant attention, and be tied up and trained, otherwise they will be damaged by the wind. Dahlias, chrysanthemums and carnations will require staking, as they become top heavy when in flower. Make the first sowing of winter-flowering sweet peas.

FORESTRY.

Complete planting out of ever-greens. Sow in nursery seeds of slow growing species such as cypress, pines, etc. All planting should be completed this month, in the early part if possible.

GENERAL.

This is a busy time for the farmer. Weeds will be very much in evidence and difficulty will be experienced in keeping them under. Stock will have fully recovered their condition, but ticks will be troublesome. The dipping tanks must be fully utilised now.

POULTRY.

Cockerels for future breeding should now have been selected, and those not good enough sold for killing. It pays far better to get rid of all of the latter, even if only at 1s. or 1s. 3d. per lb., than to keep them on, eating their heads off, in the hope of getting a better price. Those good enough for breeding, and they *must* be good, should be kept till about June; there is a demand for such up to this month, which then commences to slacken off. Any surplus at this time should be eaten or sold for what they will fetch. Of those selected for breeding purposes, the owner should keep the best one or two for his own use, with another as a reserve. No poultry keeper should sell his *best* stock, no matter how high a price is offered for it. If he does, he throws his operations back considerably.

By the end of this month the birds selected for breeding should be mated up. An article appears in this issue on the correct method of

doing so; don't put it off, and do it properly. If it is possible, the birds selected for breeding should be given a run on free range for three weeks or so before being put into the breeding pen and fed sparingly; better fertility and better chicks will be the result. If it is possible to run the birds selected for breeding away from the others during the whole of the breeding season, all the better. Any hens that become broody should be kept broody by setting a few china eggs under them until such time as eggs from the breeders come in. Broody hens at this time and for the next five months are valuable.

During the rainy season the scratching litter *must* be kept dry; if it gets wet it is useless.

Duck hatching can be continued all the year round; the main points are that the young ducks *must* be kept out of the sun and sleep on *dry* grass. Nothing is more fatal to ducklings than sun, and dampness at night; and the latter applies, too, to the adults. Unless a dry shed, with a dry, soft layer of chaff or sand, etc., covering the floor of it, is available, it is not wise to hatch turkeys till after the wet season is finished, for it will be labour, food and eggs wasted. If the young turkeys get wet they are almost certain to die. This and the feeding on wet mashes instead of dry food, chopped onions and thick milk are the chief reasons for non-success in the breeding of turkeys.

STOCK.

Cattle.—Grass will now be at its best, and no anxiety need be felt about feed. In the case of milking cows which have been fed during the earlier rainy months, a little crushed and soaked mealies, or something similar, may still be given at milking, if only to bring them quietly to their places. The importance of a clean, light, airy and well-drained shelter for calves cannot be over-estimated. Calves up to three or four months old do not require a great deal of exercise, and on wet days are better left in a dry shed with a little sweet hay. A few hours' exercise on bright days in short grass is all they need. Vigilance in keeping down ticks must not be relaxed. These remarks apply specially to milking herds and to cattle that are kraaled. Cattle running at large need little attention beyond dipping, and if the calves are not desired from November to March, the bulls must now be taken out of the herd. Weather permitting, no opportunity should be lost of getting in a supply of good sweet hay before the grass is too old.

Sheep.—Vleis and low-lying ground must be avoided. Sheds should be airy, dry and clean. If grass seeds are troublesome to woolled sheep, an area should be mown for them, or when rain begins to slacken, they may be shorn. If wire worm is troublesome, dose and move to fresh grazing and kraals.

TOBACCO.

The early tobacco should now be ready for curing. Care should be taken to select only thoroughly ripe leaf for filling the barns, so that the cured product will be uniform. Topping and suckering should be given attention. Selected seed plants should be given careful attention. New land intended for tobacco next year should be ploughed this month, so that all **organic matter** turned under may be converted into humus before planting time next season.

VEGETABLE GARDEN.

Sow now—Beans, beet, cabbage, cauliflower, lettuce, peas, onions, carrots, parsnips, turnips, endive, kohl rabi, rhubarb and all herbs.

WEATHER.

This is generally the wettest month of the year, with marked differences of from 10 inches to 15 inches on the eastern mountain ranges, 7½ inches over Mashonaland, 4 inches to 6 inches in Matabeleland, and least, but still some, rains in the Limpopo Valley. The rains may be expected to decrease in intensity after the middle of the month if the season is normal.

March.

BEE-KEEPING.

Be on the look-out for damage to stocks by the wax moth; strong stocks generally tend to obviate this pest. Where the heavy rains have penetrated the weak hive roofs and caused dampness among the quilts, these should be taken off and thoroughly dried in the sun, then replace. Contract the entrances of hives to prevent robbing. Unsold honey should be stored in a warm dry cupboard. Keep apiary clear of weeds.

CITRUS FRUITS.

Two thorough sprayings about this season, when the rains are usually practically over, at an interval of about two weeks, will often obviate the necessity for further work against scale insects until the beginning of the next wet season. If not already done, orchards should be ploughed and cross-ploughed and worked up into a really good surface, so that the cultivators can be kept going, say, every two weeks until it is necessary to irrigate, after which cultivation should be continued. If March prove a dry month, orange trees holding up a crop of fruit will probably require irrigation, but under normal weather conditions it should not be necessary. The same remarks apply as last month with regard to fruit moths. About the end of this month fall budding can be taken in hand, that is the insertion of buds that are intended to remain dormant until spring. This applies to higher altitudes, but in low country, where the growing season is extended, dormant budding should not be done until latter end of April.

CROPS.

For general cultural treatment, see February notes. Should weather permit, continue to break up new land intended for maize or other 1924 crops. If possible, plough moist vlel land for crops to be planted in May. Hay-making will continue.

* Sow now—Oats for hay or forage, barley for green feed, also lucerne, rape, swedes and turnips under irrigation. The silo pit should receive attention at once. Silage crops will in some cases be ready for cutting this month.

DAIRYING.

(See notes for February.)

ENTOMOLOGICAL.

Maize.—The stalk borers of the second brood will be found freely in the stalks, but nothing can be done at this stage. Caterpillars may attack the crop during this month, usually as a sequence to cultivation after the weeds have been allowed to get too far ahead. The caterpillars attack the crops on account of their food being suddenly destroyed. See "Some Insect Pests of Maize," *Agricultural Journal*, June, 1912; "Some Injurious Caterpillars," *Agricultural Journal*, February, 1915; and "The Maize Stalk Borer," *Agricultural Journal*, December, 1917.

Tobacco.—The crop will by this time mostly have outgrown insect injury, but any plants still infested with stem borer should be removed and burned. Leaf miner will still be in evidence, and budworms may put in an appearance. See *Agricultural Journal*, December, 1919, and February, 1920.

Potato.—Ladybirds may still be injurious. See *Agricultural Journal*, October, 1913. Careful hilling should be attended to on account of the tuber moth. See *Agricultural Journal*, February, 1910.

Cabbage Family.—Sawfly. See *Agricultural Journal*, June, 1918. The fly will probably be less injurious by this time. Cabbage louse may be on

the increase. Very thorough spraying with tobacco wash and soap is of value when the plants are young.

Beans and Cowpeas.—The most obvious enemies are the blister beetles, which destroy the blossoms. These can only be destroyed by hand. Stem maggot continues injurious, causing dropping of leaves on the larger plants, but little can be done at this stage.

Melon Family.—Plants of this family are subject to the attack of melon fly and aphid. Careful spraying with tobacco wash or paraffin emulsion is of value against the latter.

Sweet Potato.—Hawk moth caterpillars occasionally appear in countless thousands and defoliate the crop. Immediate spraying with an arsenical wash is called for when the insects first appear. See *Agricultural Journal*, June, 1912.

Citrus Trees.—Attention should constantly be given to the systematic collection and destruction of infested fruit to keep down the citrus codling. Large fruit-piercing moths may attack the fruit during the month (see under February).

Deciduous Trees.—But little damage from insects is likely to occur to these fruits during March.

Fig.—Fig weevil still calls for attention in collecting and destroying the infested fruit.

Castor Oil.—See under February.

Mosquitoes, etc.—See under previous month.

FLOWER GARDEN.

Flower seedlings for winter blooming should now be coming on, and should be planted out during showery or cloudy weather. Cuttings of carnations may now be made, and should be taken from selected plants which have borne the choicest blooms. The cuttings should be dibbled in half paraffin tins containing three parts sand to one of loam, and kept in a moist condition in a shady position sheltered from the winds. Make main sowing of winter-flowering sweet peas in a well-prepared and rich soil. *

FORESTRY.

If necessary, cultivate between the rows of trees planted out in the previous months. Plough any fire lines that are necessary and break up any new ground that will be required for next season's planting. Remember that the roots of trees penetrate deeply into the ground, and therefore plough as deeply as possible. Where black wattle thrives, sow seed this month, after well soaking.

GENERAL.

At this time the condition of stock on the veld is good—perhaps at their best. It is well, however, to look ahead and make ready for the coming winter by the provision of winter feed in such forms as veld hay, silage, baled fodder from maize, manna, oats, teff, velvet beans, and the like, and by taking steps to ensure that water will be available for the stock in winter as near their grazing ground as may be.

POULTRY.

All breeding pens should now have been mated and some eggs set. It is as well to note that the fresher an egg is when set, the better it will hatch and the stronger will be the chick from it. No eggs more than a week old should be set in an incubator or more than ten days old under a hen. Many are very hazy as to how many hens should be given to one rooster. There is no definite number; the whole point hinges upon the size of the run and the amount of scratching exercise the birds are made to take. A rooster put into a run, say, 10 ft. square could be given

only two hens, but the same rooster running on absolutely free range could be given fifty, and if all the birds are in good condition and made to take plenty of scratching exercise, practically all the eggs would be fertile. The same applies to ducks and turkeys.

When setting eggs under hens, the result of the hatch, good or otherwise, is chiefly due to the owner. If the eggs are from strong, healthy stock, and are not too old, if the nest is properly made in a cool, quiet, darkish place, kept clean and free from insects, and the hen properly fed and kept clean, the result will be good. If these precautions are not taken, the result will be failure, and the fault is not with the sitting hens. An article on incubation and rearing of chicks for best results will be found in the *Agricultural Journal* for April, 1921, and every poultry keeper is advised to study it carefully and act upon it closely if good hatching and rearing is to be expected.

Turkey eggs can now be set with safety, for by the time they hatch the rains will practically be over, and turkeys hatched now will be of good size for the following Christmas market and should fetch from 30s. to £2 10s. each as killing birds. The right time to buy turkey breeding stock is in February. When buying, go to a reliable breeder of pure-bred American Bronze turkeys; this variety is the best. It pays far better to breed from good, pure stock than from cross-bred. Don't hesitate to hatch as many stock as possible.

STOCK.

Cattle.—The precautions recommended for February apply equally to March. Arrangements should be completed for storing as much silage as it is proposed to make, so that the crops reserved for this purpose may be harvested immediately they are ready.

Sheep.—The same precautions as for February should be taken, but as less rain may be expected, conditions will probably be more favourable. If late winter lambs are not desired, the rams should be removed from the flock.

TOBACCO.

All late plants should be topped low to hasten maturity. The bales of cured leaf should be examined to ascertain whether or not the tobacco has been baled in proper condition. Seed heads should receive continued care. Land ploughed during February should be disced and rolled to assist the decomposition of organic matter. Tobacco fields already cleared of plants should be immediately ploughed.

VEGETABLE GARDEN.

The sowing calendar is the same as that recommended for last month. Plant out from seed beds cabbage and cauliflower; care should be taken during this month, as the end of the rainy season approaches, to dig with a fork all the ground in the garden. The heavy rains settle this down hard, and as soon as the dry weather begins the soil cracks and lets out all the sub-soil moisture by evaporation. As soon as the rains entirely cease, it is advisable to go over the ground and fine down with a rake, leaving some three or four inches of quite fine soil to act as an earth mulch.

WEATHER.

Rains may be looked for in considerable quantity, though less than in previous months, 5 inches in Mashonaland and 3 inches in Matabeleland being normal, with as usual more on the eastern frontier. No useful rain need be reckoned upon after the end of this month, except on the eastern border, but the rainy season tapers off in an irregular and often erratic manner and without certainty.

Southern Rhodesia Weather Bureau.

NOVEMBER AND DECEMBER, 1922.

Pressure.—During the month of November the mean barometric pressure was below normal over the whole country, and varied from 0.03 inch below normal at Bulawayo to 0.04 inch below normal at Salisbury.

The fluctuations in the barometric pressure during the month were large, the maximum range varying from 0.23 inch at Gwelo to 0.14 inch at Salisbury.

High pressure areas were present only on the 1st and 2nd, 15th to 18th, and 26th to 28th; the maximum high on the 18th was 0.05 inch above normal at Bulawayo and 0.03 inch above normal at Salisbury.

The minimum low on the 6th was 0.16 inch below normal at Bulawayo and 0.11 inch below normal at Salisbury.

During the month of December the mean barometric pressure was above normal (0.03 inch) in Matabeleland and along the eastern border (0.02 inch), and was normal in the Midlands and Northern Mashonaland.

The fluctuations in the barometric pressure during the month were large, the maximum range amounting to 0.25 inch at Bulawayo and 0.21 inch at Salisbury.

High pressure areas were present from the 2nd to 14th and on the 28th and 29th, the maximum high on the 5th being 0.18 inch above normal at Bulawayo and 0.13 inch above normal at Salisbury.

The maximum low occurred on the 20th, and was 0.07 inch below normal at Bulawayo and 0.08 inch below normal at Salisbury.

Temperature.—During November the mean temperature was above normal over the whole country, and varied from 2.5° above normal at Salisbury to 1.2° above normal at Umtali. The mean daily temperatures varied from 2.6° above normal at Salisbury to normal at Umtali, whilst the mean night temperatures varied from 2.8° above normal at Gwelo to 2.1° above normal at Bulawayo.

During December the mean temperature was above normal over the whole country, and varied from 2.9° above normal at Gwelo to 0.1° above normal at Umtali. The mean daily temperatures varied from

4° above normal at Gwelo to 1.3° below normal at Umtali, whilst the mean night temperatures varied from 1.8° above normal at Gwelo to 0.4° above normal at Salisbury.

November Rainfall.—During November the rainfall was below normal over the whole country, with the exception of Zone D (North-Eastern Mashonaland), where it was 0.8 inch above normal.

The mean rainfall recorded in the various zones during November was as under:—

	Mean rainfall.	Mean normal November rainfall.
	Inches.	Inches.
Zone A (Western Matabeleland) ...	2.33	3.22
Zone B (South-Eastern Matabeleland) ...	2.27	2.60
Zone C (Western Mashonaland) ...	2.98	3.36
Zone D (North-Eastern Mashonaland) ...	4.28	3.49
Zone E (South-Eastern Mashonaland) ...	2.91	3.69
Zone F (Eastern Border) ...	4.74	4.97

In Zone A the district with the greatest mean rainfall was Sebungwe, with 3.36 inches, and the least favoured district was Gwelo, with 1.75 inches. The heaviest rainfall during the month was 3.75 inches recorded at Inyati (Bubi district) and the least 0.91 inch recorded at Somersset Estate (Gwelo district).

In Zone B the district with the greatest mean rainfall was Matobo, with 3.00 inches, and the least favoured district was Gwanda, with 1.92 inches. The heaviest rainfall during the month was 4.34 inches recorded at Matopo Mission, and the least 1.20 inches recorded at Garth (Bulalima district).

In Zone C the district with the greatest mean rainfall was Salisbury, with 5.14 inches, and the least favoured district was Charter, with 1.99 inches. The heaviest rainfall during the month was 7.69 inches recorded at Lone Cow Estate (Lomagundi district), and the least 0.86 inch recorded at Umniati (Charter district).

In Zone D the district with the greatest mean rainfall was Mazoe, with 5.33 inches, and the least favoured district was Mtoko, with 1.67 inches. The heaviest rainfall during the month was 7.04 inches recorded at Usk (Mazoe district), and the least 1.19 inches at Makaha (Mtoko district).

In Zone E the district with the greatest mean rainfall was Melsetter, with 4.79 inches, and the least favoured district was Gutu, with 1.40 inches. The heaviest rainfall during the month was 7.36 inches recorded at Gokomere (Victoria district), and the least 0.47 inch at M'vimvi Ranch (Gutu district).

In Zone F the heaviest rainfall during the month was 10.86 inches recorded at Vermont (Melsetter district), and the least 2.64 inches at Hoboken (Umtali district).

Rain Periods.—During the 1st to 5th only light showers were recorded at a few stations in the Territory; during the 6th to 8th rain was fairly general in both Matabeleland and Mashonaland; whilst on the 9th and 10th thunder showers were frequent in Mashonaland. The 11th to 15th was a dry period generally; on the 16th fair rains were general in Western Matabeleland and Western Mashonaland, and on the 17th to 19th thunder showers were frequent in Mashonaland. The 20th to 22nd was a dry period; on the 23rd and 24th scattered thunder showers were fairly general; whilst on the 25th to 30th rain was general in Mashonaland, with scattered showers only in Matabeleland.

December Rainfall.—During December the mean rainfall was below normal over the whole country.

The mean rainfall recorded in the various zones during December was as under:—

	Mean rainfall.	Mean normal December rainfall.
	Inches.	Inches.
Zone A (Western Matabeleland) ...	3.75	5.56
Zone B (South-Eastern Matabeleland)	2.97	4.34
Zone C (Western Mashonaland) ...	4.44	5.67
Zone D (North-Eastern Mashonaland)	5.58	6.32
Zone E (South-Eastern Mashonaland)	3.09	5.64
Zone F (Eastern Border)	4.23	8.12

In Zone A the district having the greatest mean rainfall was Bulalima-Mangwe, with 4.57 inches, and the least favoured district was Gwelo, with 2.57 inches. The heaviest rainfall during the month was 5.39 inches recorded at Kalaka (Bulalima district), and the least 2.10 inches recorded at Dawn (Gwelo district).

In Zone B the district having the greatest mean rainfall was Umzingwane, with 4.08 inches, and the least favoured district was Belingwe, with 0.80 inch. The heaviest rainfall during the month was 5.50 inches recorded at Essexvale (Umzingwane district), and the least 0.53 inch recorded at Bubje Ranch (Belingwe district).

In Zone C the district having the greatest mean rainfall was Lomagundi, with 6.74 inches, and the least favoured district was North Chilimanzi, with 2.65 inches. The heaviest rainfall during the month was 9.58 inches recorded at Sangwe (Lomagundi district), and the least 1.29 inches recorded at East Clare Ranch (Gwelo district).

In Zone D the district having the greatest mean rainfall was Eastern Salisbury, with 7.20 inches, and the least favoured district was Darwin, with 3.51 inches. The heaviest rainfall during the month was 11.63 inches recorded at Goromonzi (Salisbury district) and Sunnyside (Mazoe district), and the least 2.74 inches recorded at Marston (Mazoe district).

In Zone E the district having the greatest mean rainfall was Melsetter, with 9.80 inches, and the least Chibi, with 1.21 inches.

The heaviest rainfall during the month was 9.80 inches recorded at Tom's Hope (Melsetter), and the least 0.81 inch recorded at Induna (Chilimanzi district).

In Zone F the heaviest rainfall during the month was 7.18 inches recorded at Chikore (Melsetter district), and the least 2.21 inches recorded at Melsetter.

Rain Periods.—During the 1st to 5th rain was fairly general, but more particularly in Mashonaland. The usual break between the early and more general rains occurred during the period 6th to 17th, when only isolated showers were reported anywhere. This break was considerably earlier than usual this season, as it usually occurs after Christmas. On the 18th and 19th scattered showers were reported in Mashonaland, with general rains during the period 20th to 24th. Scattered showers were reported during the period 25th to 27th, and general rains in Matabeleland, particularly during the 28th to 31st.

General Summary.—During the whole period up to the end of December the mean rainfall over the entire country was 0.6 inch below normal, and was below normal in all the zones with the exception of Zone C, where it was approximately normal, and in Zone D, where it was 2.24 inches above normal.

The mean rainfall recorded in the various zones for the period July to December is as under:—

	Mean rainfall.	Normal mean rainfall,
	Inches.	July to December.
Zone A	8.35	9.81
Zone B	7.65	8.05
Zone C	10.12	10.28
Zone D	12.98	10.74
Zone E	9.43	11.08
Zone F	11.93	17.09

During the period 1st to 19th January the position has improved considerably in Matabeleland, as rain has been recorded there fairly generally on most days. Mashonaland has also received an almost normal rainfall during January.

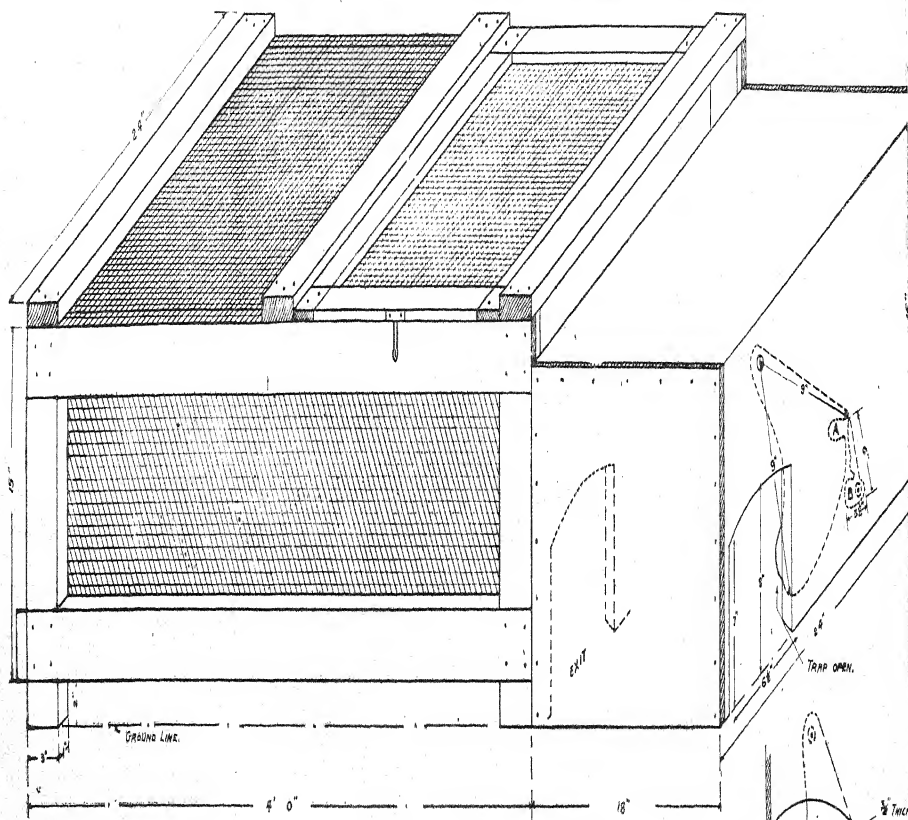
RAINFALL.

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	Nov.	Dec.		
ZONE A. :				
Bubi—				
Imbesu Kraal	2.26	2.49	6.33	9.88
Inyati	3.75	3.16	9.80	9.81
Maria Farm	1.66	4.25	8.05	n.s.
Shangani Estate	2.56	3.67	7.94	8.14
Bulalima—				
Kalaka	3.12	5.39	9.68	9.10
Riverbank	1.94	3.76	9.03	9.56
Bulawayo—				
Fairview Farm	2.17	3.65	9.12	9.29
Keendale	2.26	4.41	8.06	9.06
Lower Rangemore	2.18	3.19	8.64	9.77
Observatory	2.21	4.05	8.52	9.70
Paddy's Valley	2.35	4.12	8.42	9.65
Gwelo—				
Dawn	2.60	2.10	6.90	9.48
Somerset Estate ... ..	.91	3.04	5.60	9.89
Insiza—				
Thornville	1.12	4.23	8.07	9.41
Nyamandhlovu—				
Impondeni	3.23	3.14	8.39	...
Naseby	3.06	4.47	9.00	8.59
Gwaai Reserve	1.08	3.85	6.92	n.s.
Wankie—				
Lynwood	1.15	3.25	5.38	n.s.
Waterford	3.40	...	...	9.60
Sebungwe—				
Gokwe	3.36	4.65	10.75	12.07
ZONE B. :				
Belingwe—				
Bickwell	1.57	1.07	5.00	8.65
Bubje Ranch	2.47	.53	5.79	8.60
Bulalima—				
Edwinton	2.53	3.50	8.17	7.87
Garth	1.20	4.57	8.77	10.42
Maholi	3.29	...	...	8.20
Retreat	3.36	2.30	7.20	8.47
Sandown	1.68	...	...	n.s.
Tjompanie	1.36	2.75	5.47	9.77
Gwanda—				
Gwanda Gaol	2.07	2.81	7.92	8.33
Mtshabezi Mission	3.00	4.03	8.98	9.20
Insindini	1.86	3.53	7.70	n.s.
Limpopo	1.35	2.67	7.71	n.s.
Tuli	1.31	3.81	4.22	5.95
Insiza—				
Albany	1.26	3.23	6.43	8.50
Filabusi	1.51	2.93	6.60	8.68
Fort Rixon	2.06	2.99	8.00	8.83
Infiningwe	2.26	3.23	9.03	8.43

RAINFALL—(Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.	
	Nov.	Dec.			
ZONE B.—(Continued)					
Insiza (Continued)—					
Lancaster	1·96	..	...	n.s.
Matobo—					
Holly's Hope	2·00	...	...	5·98
Matopo Mission	4·34	2·98	10·59	8·60
Rhodes Matopo Park	2·87	4·01	10·31	8·38
Umfula	2·81	2·57	7·48	n.s.
Umzingwane—					
Essexvale	2·79	5·50	10·72	8·31
Kodhwayo	2·50	2·66	7·46	n.s.
ZONE C. :					
Charter—					
Bushy Park	2·88	7·02	12·65	9·78
Enkeldoorn	2·15	3·09	7·87	10·73
Marshbrook	2·43	1·38	7·52	10·85
Range	1·61	3·36	8·12	10·53
Umniati	·86	2·13	3·84	10·01
Vrede	2·06	4·60	8·67	10·68
Chilimanzi—					
Allanberry	2·22	1·62	5·22	9·53
Central Estates	2·74	3·69	8·44	10·50
Gwelo—					
Cross Roads	1·04	2·86	6·79	10·14
East Clare Ranch	2·26	1·29	3·85	n.s.
Globe and Phoenix Mine	·94	5·21	7·90	9·86
Gwelo Gaol	3·01	2·49	8·69	10·64
Indiva	2·75	2·95	6·85	n.s.
Lyndene	2·53	4·21	8·80	n.s.
Rhodesdale Ranch	2·76	2·00	6·76	9·71
Hartley—					
Ardgowan	2·38	3·93	9·98	10·24
Balwearie	3·40	7·16	12·23	n.s.
Beatrice...	4·56	4·96	12·16	9·80
Carnock	6·47	7·24	16·57	11·05
Philiphaugh	10·79
Cromdale	2·95	3·79	11·97	9·80
Elvington	4·04	4·78	12·79	11·77
Gatooma	3·34	7·16	13·58	11·07
Gowerlands	4·65	5·21	12·81	10·18
Hallingbury	4·33	4·36	10·79	11·20
Hartley Gaol	4·36	...	...	11·87
Hopewell	1·97	4·37	11·85	9·31
Jenkinstown	3·16	3·77	11·65	10·20
Ranwick	3·84	5·83	12·51	10·13
Spitzkop	2·59	5·24	9·37	10·35
Lomagundi—					
Argyle	5·16	5·36	12·08	10·98
Baguta	5·37	5·79	14·43	10·73
Citrus Estate	5·31	8·13	16·64	11·12
Darwendale	3·72	4·99	13·15	10·28

PICTORIAL VIEW OF TRAP NEST.



Scale $\frac{1}{4}" = 1'$

BRIGADIER ENGINEER'S OFFICE
DEPT. OF AGRICULTURE
SALISBURY 12-1-22.

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TRAP CLOSED

RAINFALL—(Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	Nov.	Dec.		
ZONE C.—(Continued)				
Lomagundi (Continued)—				
Dingley Dell	5·01	6·72	13·23	n.s.
Freda	5·24	4·39	9·63	10·50
Gambuli	3·11	6·71	12·30	11·32
Gungurubee	4·77	4·52	13·85	n.s.
Impingi... ..	4·52	7·18	14·65	n.s.
Lone Cow Estate	7·69	...	...	10·47
Mafoota... ..	5·62	8·56	15·53	n.s.
Maningwa	3·86	8·96	15·71	10·35
Mapandagutu	3·73	7·10	14·05	n.s.
Mukwe River Ranch	2·58	5·04	10·31	10·34
Nyapi	4·92	5·49	13·17	n.s.
Nyaroro	2·82	7·17	12·04	n.s.
Nyati	2·82	4·40	10·82	n.s.
Palm Tree Farm	2·16	5·26	9·23	10·81
Richmond	3·36	7·91	13·60	n.s.
Sangwe	3·49	9·58	15·43	n.s.
Silater Estate	5·18	7·68	18·62	n.s.
Sinoia	5·18	8·21	16·54	10·38
Sipolilo	6·77	4·51	12·61	10·43
Talfourd	6·01	6·78	16·45	10·68
Umboe	4·04	8·65	15·89	n.s.
Umvukwe Ranch	3·39	6·76	16·18	11·49
Salisbury—				
Avondale	5·21	7·11	14·42	11·70
Botanical Experiment Station... ..	4·98	5·58	11·92	11·60
Bromley	6·21	4·11	12·97	12·45
Cleveland Dam	3·98	6·52	12·79	9·57
Gwebi	4·80	6·98	14·93	11·12
Hillside	6·12	6·26	15·01	10·52
Lilfordia ... ..	...	6·51	...	10·36
Lochinvar	5·09	5·88	12·95	n.s.
Manor Farm	4·07	5·12	15·82	n.s.
Salisbury Gaol	6·50	6·80	15·21	11·04
Sebastopol	4·45	5·30	12·23	10·80
Selby	5·80	7·78	16·99	10·19
Stapleford	4·77	7·16	19·36	11·56
Tisbury	6·06	7·79	16·44	11·20
Vainona	5·09	8·89	16·36	12·21
Sebungwe—				
Sikombela	1·67	3·97	8·74	9·97
ZONE D. :				
Darwin—				
La Belle Esperance... ..	3·95	3·95	9·15	n.s.
Mount Darwin	6·16	3·07	10·40	10·27
Inyanga—				
Inyanga	6·75	5·41	14·49	11·43
Juliasdale	3·99	4·28	13·53	n.s.
Rhodes Estate	6·07	...	...	11·18
York	3·92	3·18	11·85	n.s.

RAINFALL—(Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.		
	Nov.	Dec.				
ZONE D (Continued)						
Makoni—						
Eagle's Nest	4.13	7.81	14.84	10.95
Forest Hill	4.52	4.86	12.48	12.46
Riversdale...	4.01	6.65	15.20	n.s.
Wensleydale	4.25	...	...	10.65
Marandellas—						
Rastenburg	5.12	5.73	13.97	n.s.
Mazoe—						
Atherstone	3.36	6.05	12.15	n.s.
Avonduur	4.31	5.39	14.59	11.72
Benridge	5.52	3.08	10.09	10.49
Bindura	3.37	5.95	11.90	10.09
Ceres	2.27	7.40	13.20	10.81
Chipoli	2.40	4.81	9.08	11.54
Citrus Estate	3.13	7.42	14.27	10.45
Craigengower	4.52	7.32	17.32	10.83
Glen Divis	5.31	6.90	14.22	n.s.
Great B...	4.06	8.08	13.70	n.s.
Kilmer	3.88	7.54	16.61	10.86
Kingston	3.49	7.09	14.78	11.27
Mazoe	1.97	4.02	10.17	9.74
Marienzi	2.50	...	...	n.s.
Marston...	4.64	2.74	9.16	n.s.
Mgutu	5.39	6.90	15.60	9.78
Omeath	3.06	8.19	15.37	9.23
Pearson Settlement	4.01	7.09	13.61	n.s.
Ruia	2.47	3.58	15.99	10.93
Ruoko Ranch	3.51	9.59	16.64	11.06
Shamva	3.53	4.44	10.06	10.57
Stanley Kop	3.55	7.52	12.03	10.23
Sunnyside	3.60	11.63	18.82	10.23
Teign	4.96	8.17	16.80	10.38
Usk	7.04	7.15	16.99	n.s.
Virginia	3.53	7.99	16.85	9.51
Visa	10.98	...	n.s.
Woodlands	3.81	5.98	11.53	n.s.
Zombi	1.74	5.87	12.15	10.70
Mrewa—						
Glen Somerset	3.07	3.64	12.26	11.92
Mrewa	6.22	6.34	19.15	11.60
Selous Nek	1.93	5.66	10.08	12.78
Mtoko—						
Makaha	1.19	5.98	10.14	11.36
Mtoko	2.15	4.75	9.44	10.02
Salisbury—						
Arcturus	3.49	7.62	16.87	n.s.
Chindamora Reserve	6.19	8.31	16.03	n.s.
Glenara	4.84	5.22	13.48	11.14
Goromonzi	3.55	11.63	18.11	12.89
Hatcliffe (Borrowdale)	5.27	7.24	17.20	10.61
Hillside (Bromley)	3.65	5.23	8.88	11.34

RAINFALL—(Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.	
	Nov.	Dec.			
ZONE D.—(Continued)					
Salisbury (Continued)—					
Kilmuir	5.13	6.55	15.78	n.s.
Meadows	5.99	5.20	15.53	12.78
Springs	4.81	7.77	17.49	n.s.
ZONE E. :					
Belingwe—					
Belingwe	1.75	1.35	4.89	n.s.
Inferno Ranch	1.10	...	...	n.s.
Shabani...	1.85	1.31	6.60	n.s.
Bikita—					
Angus Ranch	1.63	3.79	7.68	n.s.
Bikita	6.02	4.06	14.24	21.26
Devuli Ranch	3.07	3.98	9.67	n.s.
Charter—					
Buhera50	1.56	5.46	9.05
Riversdale	2.23	2.96	6.89	10.92
Chibi—					
Chibi	1.62	1.21	6.14	8.66
Chilimanzi—					
Chilimanzi	3.81	...	...	9.73
Driefontein	3.76	3.55	9.73	10.00
Felixburg	2.46	.96	5.68	9.90
Grootfontein	2.77	2.60	7.59	10.15
Induna Farm	6.34	.81	9.87	12.42
Requeza Estate	2.96	1.76	6.04	n.s.
Gutu—					
Gutu	1.81	1.70	3.51	10.22
Glenary	2.46	1.83	6.84	n.s.
M'vimvi Ranch47	2.13	5.29	10.30
Tel-el-Kebir	2.88	1.77	7.77	10.15
Gwelo—					
Lover's Walk	2.10	3.20	8.49	8.81
Oaklands	11.96
Partridge Farm	2.94	3.88	9.38	11.40
Sheep Run Farm	3.21	3.18	7.80	n.s.
Insiza—					
Roodeheuvel	2.64	2.62	7.87	9.97
Inyanga—					
St. Trias' Hill	3.64	2.88	14.28	13.07
Makoni—					
Chitora...	2.53	2.84	9.60	12.14
Craigendoran	2.98	3.27	10.02	10.69
Gorubi Springs	1.31	3.72	7.37	11.43
Mona	4.54	3.65	10.92	12.14
Monte Cassino	3.18	4.66	13.57	12.23
Rusape	3.48	2.03	12.55	10.37
Springs	2.80	...	...	11.18

RAINFALL—(Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.
	Nov.	Dec.		
Zone E.—(Continued)				
Marandellas—				
Bonongwe	3·16	...	...	11·36
Delta	3·67	3·08	8·69	12·37
Igudu	1·36	1·89	6·31	n.s.
Land Settlement	2·99	1·44	7·22	10·70
Lendy Estates	3·57	2·85	10·25	n.s.
Marandellas	2·74	5·81	16·07	12·37
Nelson	3·04	2·22	6·68	10·58
Tweedjan	2·85	2·06	6·40	12·68
White Gambolo Ranch	2·73	7·35	11·76	n.s.
Melsetter—				
Brackenbury	5·85	...	...	18·11
Tom's Hope	3·74	9·80	19·29	15·88
Ndanga—				
Doornfontein	3·91	3·11	10·14	10·30
Ndanga	2·31	2·77	10·05	14·44
Triangle Ranch	3·56	1·56	6·52	n.s.
Selukwe—				
Aberfoyle Ranch	2·49	4·09	8·84	11·00
Hillingdon	3·03	1·91	8·30	10·59
Impali Source	2·62	2·55	7·69	n.s.
Makatsi ... ..	...	...	...	n.s.
Rio	5·91	2·48	11·40	9·71
Tewkesbury	3·29	2·06	10·58	n.s.
Umtali—				
Argyll	2·08	2·65	7·04	11·51
Gilmerton	1·92	1·28	5·03	10·46
Jerain	2·64	2·51	6·33	11·41
Mutambara Mission	4·43	3·28	9·47	9·61
Odzani Power Station	3·97	2·24	8·87	12·40
Park Farm	3·73	1·73	8·20	n.s.
Premier Estate	4·26	2·33	9·13	11·22
Sarum	3·28	3·18	9·79	11·52
Stapleford	3·53	7·68	12·94	21·37
St. Augustine's Mission	4·83	3·00	10·53	n.s.
Umtali (Gaul)	4·18	2·89	8·50	21·37
Victoria—				
Brucehame	3·01	1·61	8·20	9·23
Cambria	2·31	...	...	n.s.
Chevenden	2·64	3·45	11·51	n.s.
Clipsham	3·88	2·70	9·46	11·36
Glenlivet	4·45	3·24	14·58	n.s.
Gokomere	7·36	2·01	14·34	10·56
Histonhurst	3·09	3·20	12·02	10·60
Makahori Farm	4·69	2·36	10·56	10·52
Makorsi River Ranch	1·89	3·46	8·63	11·55
Mashaba	3·25	4·10	12·72	n.s.
Morgenster Mission	4·79	...	...	14·18
M'Sali	1·87	2·84	4·71	n.s.
Riverdene North	3·44	4·74	12·24	10·80
Salemore	2·70	3·68	9·28	n.s.

RAINFALL—(Continued).

STATION.	1922.		Total to end of period.	Normal rainfall to end of period.	
	Nov.	Dec.			
ZONE E.—(Continued)					
Victoria (Continued)—					
Silver Oaks	...	3.53	1.84	8.72	11.25
Stanmore	...	2.66	4.51	9.50	10.85
Summerton	...	5.47	...	...	10.50
Tichidza	...	3.87	...	...	10.75
Victoria	...	3.24	1.34	7.31	10.08
Zimbabwe	...	2.60	3.69	10.46	n.s.
ZONE F.:					
Melsetter—					
Chikore	...	3.82	7.18	13.69	13.20
Chipinga	...	8.29	4.00	15.80	15.43
Melsetter	...	5.40	2.21	11.40	14.70
Mount Selinda	...	5.89	6.50	15.46	18.86
Vermont	...	10.86	...	...	21.16
Umtali—					
Hoboken	...	2.64	3.50	9.78	16.00

— means nil.

... means no return.

DEPARTMENT OF AGRICULTURE,
Southern Rhodesia.

Price List of Forest-Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds

OBTAINABLE AT THE GOVERNMENT FOREST NURSERY,
SALISBURY.

*Trees, 25 in tin, at 1d. each, £3 per 1,000. Orders of 5,000 or
over, £2 10s. per 1,000.*

Botanical name.	Common name.	Price of seed.		
		Lb.	Oz.	Pkt.
Callitris calcarata ...	Black pine ...	15/-	1/-	1/-
„ robusta ...	White cypress pine			
„ whytei ...	M'lanje cedar			
Casuarina cunninghamiana ...	Beefwood ...		2/-	
Cupressus arizonica				
„ lusitanica ...	Portuguese cypress ...	5/-	6d.	
„ sempervirens (var. horizontalis)	Common spreading cypress			
„ sempervirens (var. pyramidalis)	Common upright cypress			
„ torulosa ...	Himalayan cypress ...	10/-	9d.	
Cedrela toona ...	Toon tree ...	15/-	1/-	
Callistemon speciosus ...	Bottle brush ...		2/-	1/-
Eucalyptus botryoides ...	Botryoides gum ...	15/-	1/-	
„ citriodora ...	Lemon-scented gum ...	15/-	1/-	
„ crebra ...	Narrow-leaved ironbark	15/-	1/-	
„ cornuta ...	Yate tree			
„ globulus ...	Blue gum ...	15/-	1/-	
„ hemilampra ...	Red mahogany	15/-	1/-	
„ longifolia ...	Woolly butt	15/-	1/-	
„ melioidora ...	Yellow box gum	15/-	1/-	
„ maidenii ...	Maiden's gum			
„ maculata ...	Spotted gum	15/-	1/-	
„ pilularis ...	Black butt ...	15/-	1/-	
„ paniculata ...	Grey ironbark	15/-	1/-	
„ punctata ...	Leather jacket	15/-	1/-	
„ rostrata ...	Red gum ...	15/-	1/-	

Botanical name.	Common name.	Price of seed.		
		Lb.	Oz.	Pkt.
Eucalyptus resinifera ...	Red mahogany ...	15/-	1/-	
„ robusta ...	Swamp mahogany ...	15/-	1/-	
„ siderophloia ...	Broad-leaved ironbark ...	15/-	1/-	
„ sideroxylon ...	Red ironbark ...	15/-	1/-	
„ stuartiana ...	Apple-scented gum ...	15/-	1/-	
„ saligna ...	Sydney blue gum ...	15/-	1/-	
„ tereticornis ...	Forest red gum ...	15/-	1/-	
Fraxinus americana ...	American ash ...			
Grevillia robusta ...	Silky oak ...			1/-
Jacaranda mimosaefolia ...	Jacaranda ...			1/-
Ligustrum lucidum ...	Chinese privet ...			
Pinus halepensis ...	Aleppo pine ...			
„ insignis ...	Remarkable pine ...			
„ pinaster ...	Cluster pine ...			
Phytolaca dioica ...	Belhambra ...			1/-
Rhus lancea ...	Karreeboom ...	10/-	9d.	
Thuya orientalis ...	Thuya ...		1/-	1/-
Tecoma smithii ...	... ..			1/-

Trees and Shrubs, 4 in tin, at 6d. each.

Botanical name.	Common name.	Price of seed,	
		pkt.	
Bauhinia spp. ...	White and mauve flowers ...	1/-	
„ galpini ...	The pride of De Kaap ...		
Cinnamomum camphora ...	Camphor ...		
Eugenia braziliensis ...	Brazilian cherry ...		
Eugenia sp. ...			
Dalbergia sissoo ...	The sissoo ...	1/-	
Freylinia tropica ...			
Pittosporum undulatum ...	Camphor laurel ...		
Pereskea aculeata ...	Barbadoes gooseberry ...		
Populus deltoides (var. mis-souriensis) ...	Carolina poplar ...		
Photinia japonica ...	Loquat ...		
Psidium pomiferum ...	Guava ...		
Spathodea campanulata ...			
„ nilotica ...			
Sterculia platanifolia ...			

24 in tin, at 3d. each.

Aberia caffra ...	Kei apple ...	
Pittosporum undulatum ...	Camphor laurel ...	
Freylinia tropica ...		

4 in tin, at 3d. each.

Botanical name.	Common name.	Price of seed, pkt.
Casuarina euminghamiana ...	Beefwood ...	1/-
Callitris calcurata ...	Black pine	
„ robusta ...	White cypress pine.	
„ whytei ...	Manje cedar	
Cupressus arizonica ...	Arizona cypress	
„ lusitanica ...	Portuguese cypress	
„ torulosa... ..	Himalayan cypress	
„ sempervirens (var. pyramidalis)	Common upright cypress	
„ sempervirens (var. horizontalis)	Common spreading cypress	
Cedrela toona ...	Toon tree ...	1/-
Callistemon speciosus ...	Bottle brush ...	1/-
Grevillea robusta ...	Silky oak ...	1/-
Jacaranda mimosaefolia ...	Jacaranda ...	1/-
Pinus insignis ...	Remarkable pine	
„ halepensis ...	Aleppo pine	
Thuja orientalis ...	Thuja	
Populus alba ...	White poplar (suckers, at 3d. each)	
Salix babylonica ...	Weeping willow	

Trees and Shrubs, at 6d. each; extra large, up to 3s. each.

Althaea (Hibiscus syriacus) ...	Christmas rose—white	
Aloysia citriodora ...	Scented verberna—white	
Abutilon sp. ...	Chinese lantern—yellow	
„ variegated ...	„	
Acacia baileyana ...	Bailey's wattle—yellow	
„ pycnantha ...	Pycnantha wattle—yellow	
Aberia caffra ...	Kei apple	
Allamanda sp. ...	—, pink	
Bauhinia spp. ...	Bauhinia—mauve and white	1/-
„ galpinii ...	Pride of De Kaap—red	1/-
Bolusanthus speciosus ...	Rhodesia tree wistaria	
Buddleia sp. ...	—, blue	
„ sp. ...	—, orange	
Brugmansia knightii ...	Moonflower—white	
Cassia capensis ...	Cape laburnum—yellow	
Carica papaya ...	Paw paw	
Callistemon sp. ...	Bottle brush—scarlet	1/-
Ceratonja saligna ...	Locust bean	
Cestrum aurantiacum ...	Ink berry—yellow	
Cytisus scoparius ...	Broom—yellow	
Croton sylvaticus ...	Mount Selinda linden	
Dahlia imperialis ...	Tree dahlia—white	1/-
Dahlia ...	Sunflower dahlia—yellow	1/-
Duranta plumieri ...	Tree forget-me-not—blue	
Deutzia crenata ...	Bridal wreath—white	
Euphorbia fulgens... ..	—, scarlet	
„ splendens ...	Christ's thorn—red	
Gardenia florida ...	Katjepeering—white	
Holmskioldia sanguinea	—, red	
„	—, yellow	

Botanical name.	Common name.	Price of seed, pkt.
Hypericum quartianum ...	—, yellow	
„ lanceolatum ...	—, yellow	
Hibiscus sp. ...	—, double and single—red	
Heliotropium peruvianum ...	Heliotrope	
Hydrangea hortensis ...	Hydrangea—pink, blue	
Iochroma sp. ...	Iochroma—red	
„ sp. ...	—blue	
Moschosma ...	Rhodesian spirea—blue	
Lupinus arborea ...	Tree lupin—yellow	
Lagerstroemia indica ...	Pride of India—mauve and pink	
Lasiandra ...	—, purple	
Michelia champaca ...		
Melia azadarach ...	Syringa—blue	
Punica granatum ...	Pomegranate—red	
Photinia japonica ...	Loquat	
Psidium guayava ...	Guava	
Persea gratissima ...	Avocado pear (at 3/- each)	
Plumieri rubra ...	Frangipani	
Platanus orientalis... ..	Plane tree	
Plectranthus sp. ...	Rhodesian tree lobelia	
Poinsettia ...	—, double and single—red, yellow and blue	
Streptosolon jamesonii ...	—, orange	
Sterculia acerifolia ...	—, red	
Sapindus muskurossi ...	Soap nut tree	
Sensitive plant ...		
Salvia sp. ...	—, scarlet, blue and yellow	
Tecoma smithii ...		
Thevetia nerifolia ...	Thevetia	
Wistaria sinensis ...	Wistaria	
Weigelia rosea (Diervilla) ...		

Climbers and Creepers.

Botanical name.	Common name.	Plants, each.	Seed, pkt.
Aristolochia sypho ...	Dutchman's pipe ...	6d.	
Bougainvillea ...	—, magenta and brick red	1/-	
Beaumontia grandiflora ...	—, white ...	1/-	
Bignonia venusta ...	Golden shower ...	1/-	
„ sp. ...	—, mauve ...	6d.	
Jasmine ...	—, yellow and white	6d.	
„ sambac ...	—, white ...	1/-	
Hedera helix ...	Ivy ...	6d.	
Lonicera periclymenum ...	Honeysuckle—yellow	6d.	
„ sempervirens ...	„ red	6d.	
Mandevilla suaveolens ...	Mandevilla—white	6d.	1/-
Passiflora edulis ...	Granadilla ...	6d.	
„ sp. ...	Fiji granadilla ...	6d.	
Podranea brycei ...	Zimbabwe creeper—pink	6d.	1/-
Rosa bracteata ...	MacCartney rose—white	9d.	
Solanum wendlandii ...	Potato creeper—blue	6d.	

Hedge Plants.

The following species may be used as hedge plants :—

Botanical name.	Common name.
Aberia caffra ...	Kei apple
Callistemon ...	Bottle brush
Cupressus arizonica ...	Arizona cypress
„ lusitanica ...	Portuguese cypress
„ torulosa ...	Himalayan cypress
Duranta plumieri ...	Tree forget-me-not
Eugenia braziliensis ...	Brazilian cherry
Freylinia tropica ...	
Holmskioldia ...	Holmskioldia
Pittosporum undulatum ...	Camphor laurel
Ligustrum lucidum ...	Chinese privet
Rhus lancea ...	Karreeboom
Thuja orientalis ...	Thuja
Rosa bracteata ...	MacCartney rose
Punica granatum ...	Pomegranate

Departmental Notices.

The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

BOTANICAL SPECIMENS FOR IDENTIFICATION.

In all cases where a botanical identification is required it is of the utmost importance that the specimens reach the Department of Agriculture in a thoroughly dry condition, free from mildew, and intact, that is not broken in pieces. Whenever possible specimens should comprise main stem or small branch, leaves, flowers, seed vessels and roots or bulbs, though these need not necessarily be on the same plant.

The colour of the flowers and the general form of the plant should be preserved by pressing and drying between two sheets of blotting paper or newspaper. Ordinary plants not excessively succulent can be dried sufficiently in three days, provided the drying papers are changed every day. A heavy weight should be placed on the specimens in order to press them flat.

Correspondents are asked to supply the following particulars as far as possible:—

- (a) height and general appearance of plant or tree;
- (b) class of soil on which found;
- (c) locality and altitude;
- (d) supposed use or properties.

It is advised that specimens be packed between two sheets of cardboard or thin wood, since in this way they will travel long distances without fear of injury.

FARM SEEDS FOR SALE.

The undermentioned seeds grown on the Government experiment farms are offered for sale at the prices quoted. The quantities available are limited. Prices are f.o.r., Salisbury, or f.o.r., the Gwebi experiment farm. Owing to limited supply, the full delivery of any order cannot be guaranteed. Farmers are therefore requested not to enclose cheques until they are advised as to the amount of seed allotted to them. The seed is consigned carriage forward in the case of stations. In the case of sidings, the cost of railage will be notified after despatch. All applications for seed should be addressed to the Chief Agriculturist and Botanist, Department of Agriculture.

Sunflower, black (not guaranteed pure), from	
selected heads	15/- per 100 lbs.
Teff grass	9d. per lb.

CO-OPERATIVE EXPERIMENTS: WINTER CEREALS.

With a view to promoting the growing of winter cereals both under irrigation and on vlei soils, and also of introducing new varieties which may prove superior to those at present grown, the following varieties will be available for *free distribution* in small quantities from the beginning of March onwards:—

Wheat—Early Gluyas, Early Australian, Lalkasar Wali, Klein Koren, Black Persian, Pusa 4.

Oats—Kherson's 60-day, Boer oats, Old Cape Boer oats, Ruakura oats.

Barley—Smyrna (malting type).

Rye—Cape early.

Emmer.

Not more than three parcels of seed can be issued to any one applicant.

The terms under which seeds are issued for co-operative experiments are as follows:—

“That the recipient is required at the close of the season to forward to the Department of Agriculture, on forms supplied for that purpose, an accurate report on the result of his experiments with any seeds or plants supplied to him as a free issue.”

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

AGRICULTURE AND CROPS.

- No. 174. Notes on Hop Growing, by H. Godfrey Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 218. Useful Measurements for Maize, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 320. Maize Grading, by C. Mainwaring.
- No. 327. Linseed, by C. Mainwaring.
- No. 344. Ensilage, by J. A. T. Walters, B.A.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 357. Measurement of Land, by F. Eyles, F.L.S., F.S.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Arable Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- No. 394. The Interdependence of Crop Rotation and Mixed Farming, by H. G. Mundy, F.L.S.
- No. 396. Export of Maize.
- No. 397. The Advantage of Autumn and Early Winter Ploughing, by C. Mainwaring.

- No. 399. Green Manuring and Soil Management, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
 No. 400. Soil Washing, by A. C. Jennings, Assoc.Mem.Inst.C.E.
 No. 403. Florida Beggar Weed, by H. G. Mundy, F.L.S.
 No. 407. Wheat—Extracts from Bulletin No. 22, Victoria, Australia.
 No. 408. The Velvet Bean, by J. A. T. Walters, B.A.
 No. 416. Grasses of Agricultural Importance in Southern Rhodesia, by H. G. Mundy, F.L.S., G. N. Blackshaw, O.B.E., B.Sc., F.I.C., and E. V. Flack.
 No. 417. The Ground Nut or Monkey Nut, by C. Mainwaring.
 No. 422. Improvement of Rhodesian White Maize by Selection, by C. Mainwaring.
 No. 423. The Common Sunflower, by C. Mainwaring.
 No. 428. The Sweet Potato, by J. A. T. Walters, B.A.
 No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
 No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.
 Botanical Specimens for Identification.

REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.
 No. 189. The Manuring of Maize on the Government Experiment Farm, Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.
 No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.
 No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
 No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
 No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.
 No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.
 No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
 No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
 No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
 No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.
 No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
 No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.
 No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
 No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-1920.
 No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.
 No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
 No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.
 No. 432. Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S.
 No. 433. Winter Cereal Experiments, 1921, by D. E. McLoughlin.
 No. 437. Annual Report on Crop Experiments, Gwebi, 1921-22, by H. G. Mundy, F.L.S.
 No. 440. Annual Report of Experiments, 1921-22, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.

TOBACCO.

- No. 346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.
No. 398. Wildfire and Angular Spot.
No. 404. Flue-Curing Tobacco Barns and Packing House (Second Revision),
by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.
No. 410. Common Mistakes in Growing and Handling Virginia Tobacco,
by H. W. Taylor, B.Agr.
Handbook of Tobacco Culture for Planters in Southern Rhodesia,
price 2s. 6d., post free outside South Africa 3s. 6d.

STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by
Eric A. Nobbs, Ph.D., B.Sc.
No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season
1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood.
No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D.,
B.Sc., and B. Haslewood, F.S.S.
No. 231. Estimates of Maize and Tobacco Crops, 1915-16, by Eric A. Nobbs,
Ph.D., B.Sc., and B. Haslewood, F.S.S.
No. 247. Statistical Returns of Crops grown by Europeans in Southern
Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D.,
B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S.,
Statistician.
No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A.
Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
No. 286. Statistics of Live Stock and Animal Produce for the Year 1917,
by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and
F. Eyles, F.L.S.
No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles,
F.L.S.
No. 361. Statistics of Live Stock and Animal Produce for the Year 1919,
by F. Eyles, F.L.S.
No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia,
1919-1920, by H. C. K. Fynn.
No. 393. Statistics of Live Stock and Animal Produce for 1920, by
H. C. K. Fynn.
No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia
for the season 1920-21, by H. C. K. Fynn.
No. 426. Statistics of Live Stock and Animal Products for the year 1921,
by H. C. K. Fynn.

LIVE STOCK.

- No. 123. Feeding and Care of Imported Bulls, by R. C. Simmons.
No. 145. Prospects of Importation of Cattle from Australia, by E. A.
Nobbs, Ph.D., B.Sc.
No. 208. Water in the Diet of Live Stock, by L. E. W. Bevan, M.R.C.V.S.
No. 211. Fattening of Pigs on Granite Farms in Mashonaland, by
R. C. Simmons.
No. 227. An Experiment in Beef Production, by R. C. Simmons.
No. 245. Beef Feeding Experiment No. 2, by R. C. Simmons.
No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by
A. G. Holborow, F.I.C., Assistant Government Agricultural
Chemist.

- No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.
 No. 255. Pound Fees.
 No. 287. Sheep Farming for Mutton Purposes on Granite Veld and Mixed Farms, by R. C. Simmons.
 No. 292. Branding and Drafting Pens, by R. C. Simmons.
 No. 321. The Construction of Dipping Tanks for Cattle. Revised April, 1919.
 No. 336. Butchering and Flaying.
 No. 338. From Breeder to Butcher; Beef Feeding Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.
 No. 340. Notes on Theory and Practice of Feeding Cattle in Southern Rhodesia, Part III., by R. C. Simmons.
 No. 345. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part IV., by R. C. Simmons.
 No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
 No. 392. Memorandum on the Cattle Industry of Southern Rhodesia, 1921.
 No. 421. From Breeder to Butcher: Cattle Feeding Experiment No. 9, Government experiment farm. Gwebi, by E. A. Nobbs, Ph.D., B.Sc., F.H.A.S.
 ——— Arsenite Cattle Dip—How to Mix.

DAIRYING.

- No. 277. A Farm Cheese and Butter Dairy, by R. C. Simmons and G. U. Fripp.
 No. 328. Pont l'Eveque Cheese, by J. B. Fisher, N.D.D.
 No. 329. Gervais Cheese, by J. B. Fisher, N.D.D.
 No. 356. Cream and its Production, by T. Hamilton.
 No. 370. Development of Flavour in Butter, by T. Hamilton, M.A., N.D.A., N.D.D.
 No. 383. Control of Temperature in Dairying, by T. Hamilton, M.A., N.D.A., N.D.D.
 No. 395. Farm Butter Making, by T. Hamilton, M.A., N.D.D., N.D.A.
 No. 401. Milk Records and Milk Testing, by T. Hamilton, M.A., N.D.A., N.D.D.
 No. 418. Manufacture of Cheddar Cheese, by T. Hamilton, M.A., N.D.A., N.D.D.
 No. 427. Common Defects in Butter-making, by T. Hamilton, M.A., N.D.A., N.D.D.

VETERINARY.

- No. 51. Strangles, by F. D. Ferguson, M.R.C.V.S.
 No. 121. Rabies, by Ll. E. W. Bevan, M.R.C.V.S., and T. G. Millington, M.R.C.V.S., D.V.H.
 No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
 No. 313. Obstruction in Sheath of Ox, by J. M. Sinclair, M.R.C.V.S.
 No. 316. Inoculation of Cattle against Redwater and Gall-sickness, by Ll. E. W. Bevan, M.R.C.V.S.
 No. 324. Infectious Abortion of Cattle, by Ll. E. W. Bevan, M.R.C.V.S. Services of Government Veterinary Surgeons.
 No. 352. African Coast Fever, by L. E. W. Bevan, M.R.C.V.S.
 No. 364. Round-worm Infection of Calves, by H. E. Hornby, M.R.C.V.S.
 No. 367. Quarter-evil, by C. R. Edmonds, M.R.C.V.S.
 No. 431. History, Control and Treatment of Infectious Abortion in Cattle in Southern Rhodesia, by Ll. E. W. Bevan, M.R.C.V.S.
 No. 435. A Short History of Infective Diseases, by J. M. Sinclair, M.R.C.V.S.
 Redwater Treatment and Gall Sickness.

IRRIGATION.

- No. 206. Hints on Irrigation: Small Earthen Storage Reservoirs, by W. M. Watt.
No. 270. Odzani River Irrigation Scheme, by W. M. Watt.
No. 300. The Dangers and Prevention of Soil Erosion, by W. M. Watt.
No. 349. The Hydraulic Ram, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
No. 376. Notes on the Water Law of Southern Rhodesia, by R. McIlwaine, M.A., LL.B.
No 384. The Application of Water in Irrigation, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.
No. 412. Water Power Resources of Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
No. 419. Irrigation Canals, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E. Engineering Advice.

FORESTRY.

- No. 199. Eucalypts for the Farm, by J. J. Boocock.
No. 366. The Management of Woods, by J. S. Henkel.
No. 379. Price List of Forest Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds.
No. 386. Forestry in Rhodesia: Improvement Fellings on the Farm, by J. S. Henkel.

HORTICULTURE.

- No. 75. Fumigation of Fruit Trees with Hydrocyanic Acid Gas, by R. W. Jack, F.E.S.
No. 354. The Home Orchard, by A. G. Turner.
No. 424. Citrus Fruit Growing in Rhodesia, by A. G. Turner.

ENTOMOLOGY AND VEGETABLE PATHOLOGY.

- No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.
No. 147. Root Gallworm, by R. W. Jack, F.E.S.
No. 158. Two Ladybirds Injurious to Potato Plants, by R. W. Jack, F.E.S.
No. 171. The Cabbage Web-Worm—A Pest of Cabbage and Allied Plants, by R. W. Jack, F.E.S.
No. 172. Diseases of the Potato Tuber and the Selection of Sound Seed, by R. W. Jack, F.E.S.
No. 178. Illustrations of Natural Forest in relation to Tsetse Fly, by R. W. Jack, F.E.S.
No. 187. The Dusty Surface Beetle, by Rupert W. Jack, F.E.S.
No. 197. Chafer Beetles, by R. W. Jack, F.E.S.
No. 204. Some Injurious Caterpillars, by R. W. Jack, F.E.S.
No. 214. Some Household Insects, by R. Lowe Thompson, B.A.
No. 219. More Household Insects, by R. Lowe Thompson, B.A.
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 The Analyses of Agricultural Products, Soils, Water, etc.
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Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 552.]

[8th December, 1922.

IT is hereby notified that His Honour the Acting Administrator has been pleased, under section 5 of "The Pounds and Trespasses Ordinance, 1903," at the request of the Civil Commissioner, Fort Victoria, to establish a pound on Gungwe Farm, Gutu native district, and that the said pound is now available for the public.

No. 553.]

[8th December, 1922.

HIS Honour the Acting Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 331 of 1922, and, in terms of section 17 of Government Notice No. 21 of 1917, declare the following areas of infection and guard areas in lieu thereof:—

NATIVE DISTRICT OF MELSETTER.

(a) *Areas of Infection.*

1. The farms Merino, Smalldeel, Sable Home, Hermit, Umzelezwe, Bamboo Creek and Elandsberg.
2. Randfontein, Nooitgedacht and Avonduur.

(b) *Guard Areas.*

1. That portion of the native district of Melsetter lying south of and including the farms Grampians, Umzila, Grass Flats, Daisy Hill, Geluk, Chikora Annex, Chikore and the Musikiwanu Reserve.
 2. An area bounded by and including the Ngorima Reserve, the farms Uitkyk, that portion of Voorspoed south of the Lusitu River, Sterkstroom, Clearwater, Wedge Hill, Newcastle, Landsdown, Heilrand, Canterbury, Woodstock, Enhoeck, Ravenswood, Wolfscrag, Helvetia, and the Portuguese boundary.
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No. 567.]

[22nd December, 1922.

HIS Honour the Acting Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 271 of 1922, and, in terms of section 17 of Government Notice No. 21 of 1917, to declare the following areas of infection and guard area in lieu thereof:—

CHARTER AND CHILIMANZI NATIVE DISTRICTS.

(a) *Areas of Infection.*

1. The Wiltshire and Worcestershire Estates.
2. The farm Swartfontein.
3. The farm Chipisa.
4. The farm Mooifontein.
5. An area within a radius of four miles of Mswuna's Kraal in the Sabi Reserve.

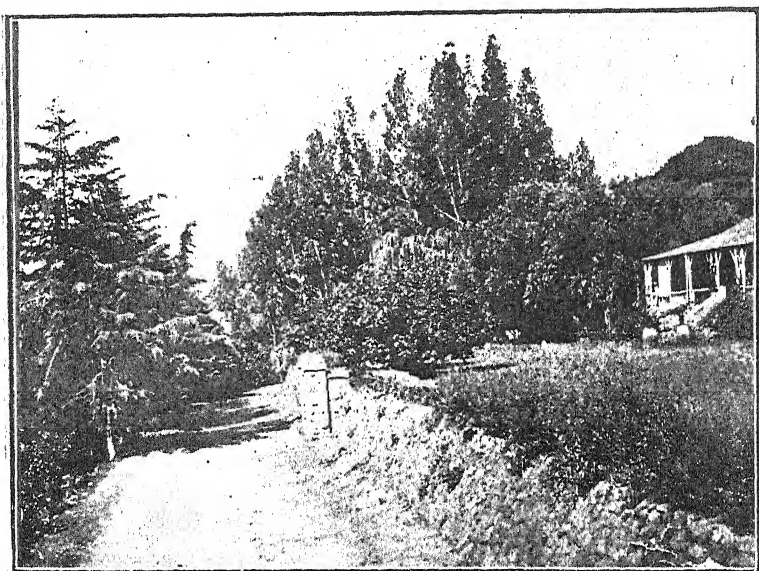
HARTLEY, MARANDELLAS, CHARTER, CHILIMANZI AND GUTU
NATIVE DISTRICTS.(b) *Guard Area.*

An area bounded by and including the farms Palmiet Vlei, Mserenge, Glynn, Bucknall, Sunnyside, Vergenoeg, Alpha, Espy, Bow, Dean, Lilliefontein, Lovedale, Hopley's, Bitu, Sabi, Goto, Kundu; thence down the Sabi River to its junction with the Runwengi River; thence up the latter to its headwaters; thence in a south-easterly direction to the headwaters of the Nyamhonga River and down this river to its junction with the Nyadzidza River and up the latter, the Inyazitza and Nyamatsetse Rivers to the farm Riversdale; thence by and including the farms Riversdale, Welwart, Lionsdale, Silverdale, Geluk, Shasha Fountains, Driefontein A and B, Grootfontein, Mtao, Murchiston, Fairview, Hartbeestefontein, Intete, Chesa, Judaea, Umvuma Commonage, that portion of the Central Estates lying north-west of the Umvuma-Rhodesdale road, Railway, Antelope, Bester's Rust, Manzi, Crocodile, Hampshire, Kwesfontein, Dorasdale, Riversdale, Nieuwejaarsfontein, Bathurst, Springvale, Adelina, Morrell and Relevant.

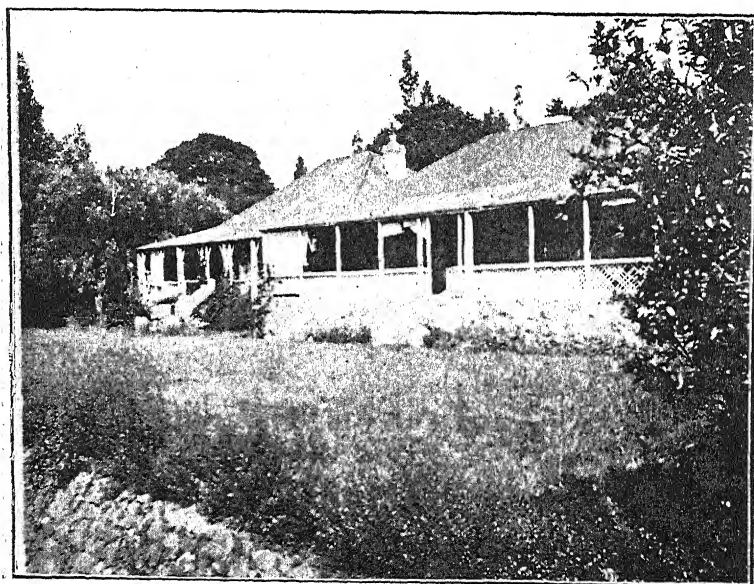
No. 37.]

[19th January, 1923.]

HIS Honour the Acting Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 223 of 1922, declaring the farm Dunstal, sub-division 3, in the district of Bulawayo, an area infected with swine fever.



Rhodes Inyanga Ranch.



Homestead at Rhodes Inyanga Ranch.



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APRIL, 1923.

[No. 2.

Editorial.

Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to :—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.

Rhodesia Agricultural Union.—For over a year the ordinary activities of the Rhodesia Agricultural Union have been disturbed by constitutional questions. The last two Congresses have given much time to the problem, which has been threshed out in detail there and at meetings of associations all over the country. It would appear that now a solution has been found on the lines of voluntary contribution, amicable co-operation with allied bodies, exclusion of party politics, and co-operation in the widest sense of that term. During its struggles the Union has had the advantage of the guiding hand for three consecutive years of Mr. C. S. Jobling as president, who has now handed over these onerous duties to Mr. J. A. Edmonds, a former president. The outlook of the Union is to a year of considerable activity and

development. The agenda, including several unopposed motions of an urgent character, comprised some sixty resolutions on very varied topics, a full account of which appears in the daily Press.

Horse-sickness.—This disease has been exceptionally prevalent throughout the Territory during the present season and has caused a heavy mortality among horses and mules. The President of the Rhodesia Agricultural Union, in his inaugural address to Congress, made a brief reference to the subject, explaining the reason for the withdrawal of the vaccine issued by the Director of Veterinary Research for the inoculation of horses.

The facts are that in 1921, during the absence of Mr. Bevan on vacation leave, the vaccine hitherto in use died out, and on his return it became necessary for him to issue hurriedly another in order to inoculate horses prior to the onset of the horse-sickness season. Between 400 and 500 doses of the new vaccine were issued, to be applied by the District Veterinary Surgeons to horses not exceeding two-and-a-half years of age, before it was found that in a large number of cases it was producing no re-action by reason of some degree of natural resistance which young animals were found to possess; in such instances no immunity was derived. As soon as this was discovered the Director of Veterinary Research offered to supply free of charge a stronger vaccine for the inoculation of those horses which had failed to re-act, but as less than one hundred doses of this stronger vaccine were applied for, it is probable that a considerable number of animals inoculated with the first vaccine are among the many horses which have died from horse-sickness during the present season. Although this unfortunate incident is greatly to be regretted, in fairness to Mr. Bevan it should be pointed out that the general inoculation of horses for the public has been carried out in response to the public demand rather than in accordance with his wishes, since in his annual reports he has consistently urged the necessity for further experiments in order to place his method upon a basis of scientific accuracy and safety before applying it to the general inoculation of horses for the public.

When it is remembered that the causal organism of horse-sickness is unknown to science, it being so small that it cannot be viewed under the highest powers of the microscope, and can pass through the finest grained porcelain filter; that the method of natural transmission has not been determined; and that it still remains to be shown how one strain of virus differs from another and one animal offers greater resistance to infection than another, the difficulties associated with the investigation of the disease will be appreciated. In spite of these difficulties the method of inoculation evolved by Mr. Bevan has been applied in the past with conspicuous success, and its usefulness is demonstrated by the results obtained with the inoculated Police horses during the present very severe season. At the time of writing we are informed that of 271 inoculated Police horses on the strength, as from 1st January, 1923, there have been only seven deaths from horse-sickness,

a mortality of little more than 2.5 per cent. When it is remembered that Police horses are distributed throughout the country—many of them in the most unhealthy districts—and by reason of the duties which have to be performed are necessarily exposed to exceptional risks of infection, these results may be considered highly satisfactory. It may be pointed out, however, that this to a large extent is due to the care which is exercised in connection with these horses, which are temperatured daily, and are not permitted to be used when any abnormality is noticed. It is believed that if the same procedure were adopted by private owners of inoculated horses the mortality of such horses might be similarly reduced.

Although it is to be hoped that only a few weeks remain of the present horse-sickness season, we would urge the owners of inoculated horses to watch carefully for any relapse or re-infection, and to avoid using the animal or submitting it to any exercise should there be any indications of sickness. Among Police horses it is found that every year a large number become re-infected, but if these are put by until the temperature is again normal and are not used for some weeks, the great majority recover. As evidence of this we might mention that in the year 1918 only 3 per cent. died of exposure; in 1919 3.4 per cent.; in 1920 2 per cent.; and in 1921 less than 1 per cent., showing that death in the case of re-infected inoculated animals carefully treated should be the exception rather than the rule.

With regard to the possibility of the re-introduction of the inoculation method, it is the desire of the Director of Veterinary Research to proceed with his investigations with a view to placing the process upon a more satisfactory and scientific basis in order that in future it may be possible to inoculate horses of all ages with safety and uniform results.

Fruit Growers' Exchange of South Africa, Ltd.—We have from time to time in this *Journal* published information in regard to the Fruit Growers' Exchange, and it may be of interest to summarise briefly the present position. The Exchange was registered under the Union Companies Act in August, 1922, and subsequently under the new Co-operative Societies Act in December, 1922. The first annual meeting of shareholders was held in October, 1922, but as it had not been possible then to register under the Co-operative Societies Act, the temporary committee elected in April, 1922, was requested to carry on until the annual general meeting convened for March, 1923. At this meeting a permanent board is to be elected to complete the construction of the Exchange as laid down at the conference held in April, 1922. The board will consist of fifteen directors, eight representing citrus areas, five deciduous areas and two pineapple areas. Each division, that is citrus, deciduous and pines, will have full control of its own affairs, except that any one division will not have the right to vote the expenditure of more money than it is estimated that particular division will produce by the levy during any one season. If it should be found

necessary to incur greater expenditure, the matter will have to be referred to the whole board. The number of associations at present affiliated is thirty-five. These associations have not at the present time all formed district associations as required by the constitution of the Exchange, and some have been allowed to affiliate with the Exchange direct, as, for instance, the Rhodesian Co-operative Fruit Growers' Association, Ltd. On the 27th March, 1923, the temporary board of directors meet in Pretoria in order to draw up a report to be submitted to the general meeting to be held the next day. The permanent board will be elected so as to represent as nearly as possible all the different fruit growing areas of the Union and Rhodesia.

The main operations of the Exchange have been concerned with completing the organisation in conformity with the constitution of the Exchange and the requirements of the Co-operative Societies Act and arranging for shipping facilities. Much improvement has taken place in the accommodation provided as well as in the methods of handling the fruit since the inception of the Exchange. A small beginning has been made to advertise South African fruit overseas, and preliminary measures have been taken for the establishment of an office in London.

The difficulties encountered by the Exchange have been very considerable, and delay has been unavoidable. The way is now cleared and the final stage reached. The Exchange will assume full control of the fruit export trade of the sub-continent, and will be thoroughly representative of the fruit growers of the country.

Representations from the Rhodesian Co-operative Fruit Growers' Association, Ltd., to the Rhodesian Railway Administration have resulted in the reduction of the rate for citrus fruit exported *via* Capetown, and on the importation of shooek *ex* Beira. These reductions amount approximately to 6d. per box of fruit exported, and 1½d. on the shooek imported, and go to show the advantage of co-operative effort.

Rhodesian Cheese.—It has been assumed by some that Rhodesia was a country in which good cheese could not be made, but this season, in actual practice, cheese has been produced of a quality equalling, it is said, that produced in the Union, where the standard is extremely high. Certain initial difficulties with regard to plant and equipment will have to be overcome before we can hope to manufacture cheese in bulk, but tentative experiments which have been made during the past season with a makeshift plant on various farms in this Territory have amply demonstrated the fact that all difficulties can be overcome by the exercise of a little care and foresight.

It is pleasing to note that the Salisbury merchants are encouraging the sale of locally made cheese, which is in considerable demand. It is therefore hoped that by next season a new industry will be firmly established in our midst which will provide a lucrative outlet to dairy farmers for the milk produced on their farms.

A word of warning must be uttered to those who are making cheese for the first time, because it is a well-known fact that every district is not suited for the manufacture of first grade cheese on a commercial scale. Certain peculiarities of veld and of climate make it possible to make good quality cheese in one district or on one particular farm in a district, whereas the same methods adopted elsewhere may result in failure. Those who contemplate making cheese on a commercial scale would be well advised to seek expert advice and to manufacture in a tentative manner before installing an expensive plant which might prove a waste of money. This peculiarity as regards cheese making is not confined to Rhodesia. In the Union of South Africa it is a well-recognised fact that certain districts are better adapted for cheese making than others, and it has taken some years to demonstrate this clearly. The waste of material and money there has been considerable, and farmers in Rhodesia should take notice of the failures of others who have learnt by bitter experience that cheese making requires special conditions and special knowledge. The article entitled "Farm Cheese-making" which appeared in the last two issues of this *Journal* is now available in bulletin form, and can be obtained upon application from the Department of Agriculture.

Cotton Culture.—Rhodesian farmers are again becoming interested in cotton cultivation. In 1919-20 a number of farmers, located in several districts, planted trial plots of cotton, the plots ranging in size from one to fifty acres. The results obtained varied from absolute failure in some cases to satisfactory yields in others. The quality of the lint produced was favourably reported upon by brokers and manufacturers in Great Britain.

Many farmers wished then to continue cotton growing, but unfortunately the machinery supplied for preparing cotton for market was unsuitable for the purpose, and the production of cotton was reluctantly abandoned by farmers chiefly on account of marketing difficulties. The same difficulties exist to-day, but they are not insuperable, and if adequate machinery is obtained for handling the crop, cotton will become a crop of commercial importance in certain areas of Southern Rhodesia.

Plans are at present being made to carry out experiments in native cotton growing, particularly in the Umtali district. If these experiments are successful, natives in Southern Rhodesia will no doubt take up cotton growing as they have done in Nyasaland, Uganda and Nigeria. This movement, if successful, will be of great benefit to the native population, and will add materially to the wealth of the country.

In the Union cotton growing has made satisfactory progress, and is now an important source of revenue to an increasing number of farmers. Sir Henry Dundas and Mr. G. F. Keatinge, representing the Empire Cotton Growing Corporation, have recently made an extensive tour of the Union to report upon the possibilities of cotton growing in that

part of South Africa. Unfortunately they were unable to visit this Territory. In order to better assist the development of cotton growing in the Union, a Cotton Institute has been established. This was brought about by attaching the Tobacco and Cotton Division, of the Department of Agriculture, to the Transvaal University. Under the new arrangement cotton investigations, research and teaching are now under one organisation.

The Agricultural Department of Southern Rhodesia, although realising present difficulties in regard to marketing, has not abandoned the belief that cotton will become a crop of commercial importance in certain areas. This season variety trials are being carried out with upland cotton at Virginia Estate. These varieties are being grown under ordinary field conditions without irrigation. In addition a trial is being made with Pima, Egyptian, cotton under irrigation at Sinoia and Umtali. It is yet too early to state what results will be obtained, but the experiments appear promising at present. The final results will of course be published at the earliest possible date.

White v. Yellow Maize.—We would draw attention to the article dealing with this subject written for this issue of the *Journal* by the Chief Chemist. The subject is of particular interest to the maize grower of this country, and should be read carefully. For some time there has been a controversy in Rhodesia as well as in the Union as to which type is the more profitable to grow. The latest addition to the discussion is the assumption, apparently accepted unquestionably by some, that yellow maize possesses in a greater measure that elusive substance known as Vitamin A, which is said to be specially important for bone development and growth. This assumption is based upon a deduction drawn from certain feeding experiments carried out in America. In order to follow properly this new development we would advise our readers to peruse the article on vitamins which appears in this issue. The presence of a particular vitamin in any class of food-stuffs can only be determined by feeding tests, and the Chief Chemist observes that the amount of evidence so far adduced in favour of yellow maize as regards Vitamin A content is not overwhelmingly conclusive, and he places in its proper perspective the knowledge at present available. In this connection it is well to remember that whilst experimentally animals may be fed entirely on yellow or white maize alone, in practice they receive a mixed ration containing ample supplies of the various vitamins they require. His article is a timely and valuable contribution to the subject, and will, we are sure, be widely read.

Milk Records.—The milk records which are published periodically in this *Journal* are sent in by the owners of the cows. At our present stage of development, it is manifestly impossible for reasons of finance to employ an official recorder, who can check the weights and tests of

the cows entered in the records. As opportunity offers, however, the Dairy Expert makes a check test of the milk being produced by the cows in test, and at the same time he takes a test of a sample of mixed milk in order to ascertain the average percentage of butter fat contained therein. With this average percentage as a basis it is of course possible to calculate the production of butter fat throughout the whole herd. This is really of greater consequence to the farmer than the test of one or two individual cows.

Within the past month the mixed milk from the herds belonging to three farmers who have supported the milk-recording scheme from its inception has been tested by the Dairy Expert on the respective farms, and a rather unexpected result has been obtained. These three herds, belonging to Messrs. Struthers and Pickering, of Sinoia, and Mr. C. F. Anthony, of Gwelo, are all of the Friesland breed, and each is headed by a pedigree Friesland bull. The tests proved in each case to be most gratifying. The mixed milk of Mr. Pickering's herd tested 4.7 per cent. butter fat, Mr. Struthers' herd tested 4.4 per cent., whilst Mr. Anthony's herd also tested 4.4 per cent. The samples in each case were most carefully taken, and the tests carefully made. The Friesland breed has the reputation of giving low quality milk, but these tests seem to disprove this, and to show that under Rhodesian conditions the Friesland cow gives as high, if not higher, a quality of milk as that of any other breed.

Third Egg Laying Test.—This test terminated on the 2nd March last, and a report will shortly be issued by the Poultry Expert giving full details. In the light breeds Mrs. Mitchell, of Salisbury, secured premier honours with a pen of White Leghorns. This pen of five birds during the period of the test—48 weeks—laid 926 eggs of 2 ozs. and over, and 33 eggs under 2 ozs. The best individual producer on the test was a bird of this pen with a total of 229 eggs of 2 ozs. and over. The second and third positions were secured by the Golden Grove Poultry Farm and the Weymouth Poultry Farm respectively with White Leghorns. In the heavy breed section Mrs. Colborne was first with Black Orpingtons. Her five birds laid 825 eggs of 2 ozs. and over, and 41 eggs under 2 ozs. The best individual layer in the heavy breed section was a Rhode Island Red belonging to Mrs. Skillen, of Salisbury. This bird laid 171 eggs of 2 ozs. and over. Rhode Island Reds sent in by Mrs. Watson, of Glendale, and Mrs. Bernard, of Headlands, secured second and third places respectively. The total number of eggs produced by the light breeds was 10,734, an average of 153.34 eggs per bird. The heavy breeds laid 4,093 eggs, an average of 136.43 eggs per bird.

The fourth egg laying test commences on 1st April, the conditions being the same as hitherto. All the pens have been allotted, and there is a greater variety of breeds entered. The results will as usual be published periodically in the Press.

Broom Corn.—For a number of years broom corn has been grown, more or less spasmodically, in the districts south of Umtali. Manufacturers in the Union have reported favourably, but not enthusiastically, on the fibre produced here. Improvement should not be difficult, and if prices were attractive enough pains would be taken to produce the desired article. Insect pests do attack it, but not so much as to forbid its cultivation, and there is no reason to think that this plant cannot be successfully grown as a crop wherever kaffir corn, with which it is closely related, is grown.

It is therefore interesting to learn that Mr. R. Wodehouse, of Penkridge, near Umtali, who has all along been a pioneer of this crop, is now not only growing broom corn, but also manufacturing brooms and meeting a ready sale for his products in competition with the imported article. His enterprise and persistence deserve the reward he is now reaping. This is a rural industry involving no urban requirements, for although certain machinery is used, yet hand labour is essential, and the chief raw product is farm grown. The handles still come from America or the Union, though there seems no reason why local wood should not be found for this purpose, since but small dimensions of a light, tough, non-splintering nature are all that is required.

The Tobacco Industry.—Matters of considerable importance to the tobacco growing industry were discussed at the conference of South African tobacco growers held in Capetown on the 12th February. The growers of Southern Rhodesia were represented by Mr. Reid Rowland, while Mr. H. W. Taylor, Tobacco Expert, attended on behalf of the Governments of both Southern and Northern Rhodesia. The most important subjects in so far as this Territory is concerned were those referring to overseas markets and Imperial preference. The two items were taken together, and in the course of the discussion it was stated that the amount of tobacco required by the manufacturers in the Union was approximately 13,000,000 lbs. The Union at present produces approximately that quantity of European grown tobacco, Southern Rhodesia about 3,500,000 lbs., Northern Rhodesia about 1,000,000 lbs., so that there is now an actual surplus of leaf tobacco in South Africa available for manufacture. The delegates from each centre were satisfied that overseas markets could be found for their surplus leaf, but the whole question depended upon prices. The delegate from Nyasaland pointed out that whilst the Imperial preference no doubt assisted in the marketing of tobacco in Great Britain, the producer received no direct benefit. The present preference amounted to only 1d. per ounce, and this was not sufficient to make the manufactured article cheaper to the consumer; hence the public continued to smoke well-known brands manufactured from leaf produced in foreign countries. At present Empire-grown tobacco could only be used by manufacturers for blending, and as long as this practice continued there would be no real demand for colonial-grown tobacco. Manufacturers had stated that if the Imperial preference was increased they could offer the public

cheaper manufactured tobacco, and thereby increase the demand for Empire-grown tobacco. The conference finally passed a resolution as follows :—

“That this conference of tobacco growers is of the opinion that in order to stimulate increased production of Empire-grown tobacco an increased Imperial preference is necessary. That this preference should be sufficient to induce the consuming public to smoke Empire-grown tobacco.”

This resolution, with others, was submitted to the Prime Minister of the Union by a deputation from the conference. General Smuts undertook to bring the matter before the Imperial Conference for consideration.

The Year's Trade.—The trade returns for the year 1922 show that we exported from Southern Rhodesia 19,405 head of slaughter cattle, valued at £100,072, compared with 8,965 head, valued at £77,119, in 1921. The value of all other cattle exported during 1922 is given as £25,803 against £37,009 in 1921. We exported 277,700 lbs. of butter, valued at £25,186, in 1922, but found it necessary to import 172,225 lbs. at a cost of £12,053. The value of maize and maize meal exported during 1922 amounted to £38,323, and our imports during the same year totalled £27,288. Of the former amount, exports during the months of January and February accounted for £24,127, being portion of the previous season's crop. In spite of the severe drought experienced early in the year, we exported 2,268,768 lbs. of tobacco during 1922, compared with 2,404,141 lbs., valued at £196,702, in 1921. There was a better market for hides and skins in 1922, and 1,301,728, valued at £35,930, were sent away, compared with 695,001, valued at £18,305, in 1921. We exported 231,301 eggs in 1922, but found it necessary to import 300,397. Our exports of hams and bacon declined from 116,948, valued at £10,634, in 1921, to 108,992, valued at £7,251, in 1922. Our imports of cheese are decreasing, the values being £6,007 in 1922 and £10,402 in 1921. The biggest item in our bill for foodstuffs is £81,869 paid for wheat and wheaten flour. Rice still figures in our import list, and in 1922 cost us £6,127.

Rhodesia Egg Circle.—Some time ago it was announced that Gwelo had established an egg circle, and since then we understand it has been successful in securing a market in the Congo as well as locally. We are now glad to hear that another circle has been formed for the poultry farmers in the vicinity of Salisbury. The necessary membership and funds having been secured, a strong committee has been appointed, with a smaller board of management for the control of details. Good progress has also been made towards the establishment of circles at Umtali and Bulawayo. At Umtali the necessary number of shares have been taken up, and preparations are being made to

commence operations at an early date. In this way the organisation of the trade in eggs is becoming an accomplished fact, a step thus calculated to benefit very materially both the producer and the consumer.

The First Rhodesian Tobacco.—In our issue for December, 1922, we published an extract from the proceedings of the Rhodesia Scientific Association dated 27th March, 1901, wherein reference is made to an exhibit of tobacco grown by Mr. R. J. Evans, of River View, Filabusi. This, as we stated, is the earliest record of tobacco being grown by a European in the Territory. Since our editorial notice appeared we have had a letter from Mr. Evans, who, we are pleased to say, is still in the Territory, in which he states:—"It is gratifying to me to know that my early efforts have not passed by unrecorded, and I value the placing on record of the facts stated in your *Journal*. The farm in question is called Limerick, River View being the name of my house, which was situated on the banks of the Umzingwane River." We are glad to publish this statement, as it clears up any ambiguity as to the locality in which the tobacco was grown.

Manufacture of Roofing Tiles.—The article which appears in this issue of the *Journal*, written by Mr. Arthur Orner, of the American Board Mission at Mount Silinda, will, we are sure, be read with great interest. It will probably be news to many that roofing tiles have been manufactured and used in Southern Rhodesia for more than twenty-five years. To those who as a result of this article are stimulated to make tiles we would emphasise the importance of using proper clay, as otherwise it may be found after burning that the tiles are worthless. Mr. Orner authorises us to state that he would be pleased to receive samples of clays from ten to twenty pounds and to test them by making up into tiles and burning, when he would be able to return a tile with his suggestions to the interested party. The clay could be sent by agricultural post, and would not cost much in this way. Time and expense are involved in the process of testing, and a charge of £1 will therefore be made for each sample tested.

Malaria and Blackwater Fever.—An abnormally wet season in Southern Rhodesia usually brings in its wake an increase in the incidence of malaria and blackwater fever, and there is no reason for supposing that the present season will prove otherwise. We therefore draw attention to a circular which has been sent by the Medical Director to farmers. The circular is a reprint of an article which appeared in *The Rhodesia Herald* of 15th December, 1922, and embodies in it twelve simple rules recommended for the avoidance of malaria and blackwater fever. These rules were drawn up by the Medical Director some years

ago, and have been obtainable in printed form from this office as Bulletin No. 274, still in print.

Health is all-important, especially to those farming in the out-lying districts, and we earnestly recommend the practical application of these simple yet essential rules by all exposed to infection.

Quinine supplied by Government is now obtainable at some one hundred and fifty agencies throughout the Territory, but it may be that in some districts farmers may experience difficulty in buying this necessary drug. If any farmer is experiencing this trouble the Public Health Department, Salisbury, would be glad if they could be notified, when every endeavour will be made to furnish supplies, the desire being to do everything possible to bring the purchase of quinine within the reach of all.

Illustrations.—The illustration of a residence given in our last issue inadvertently as Histonhurst, Victoria, is the home of Mr E. Schultz, Slangfontein, Eukeldoorn.

“Rhodesia Agricultural Journal” Back Numbers.

The following back numbers of the *Rhodesia Agricultural Journal* can be obtained from Mr. F. W. Hunt, P.O. Gwanda, at cost, plus postage :—

- 1914—Vol. xi., Nos. 5, 6, 7, 8.
- 1915—Vol. xii., Nos. 1, 2, 3, 4, 5.
- 1916—Vol. xiii., Nos. 2, 3, 4, 5, 6.
- 1917—Vol. xiv., Nos. 1, 2, 3, 4, 5, 6.
- 1918—Vol. xv., Nos. 1, 2, 3, 4, 5.
- 1919—Vol. xvi., Nos. 1, 2, 3, 4, 5, 6.
- 1920—Vol. xvii., Nos. 2, 3, 4, 5, 6.
- 1921—Vol. xviii., Nos. 1, 2, 4, 6.

The Rearing of Bacon Pigs for Bacon Factory Purposes.

By T. HAMILTON, M.A., N.D.A., N.D.D., Dairy Expert.

The following figures will give farmers some idea of the vast extent of the imports of pig products into the United Kingdom. It is interesting to note that in 1919 the total value of pig products imported into the United Kingdom was in excess of that of any other commodity. In pre-war times it was exceeded only by wheat, wool and the total of all other meats.

Imports of pig products into Great Britain, 1919:—

	Cwts.	Value.
Bacon	8,281,198	£73,591,919
Lard	2,178,330	18,673,125
Hams	1,813,154	16,089,697
Salted pork	24,074	175,588
Frozen pork	136,189	899,975
Total	12,432,945	£109,430,304

The figures for 1919, which were largely war contracts, were of course exceptional both as regards quantity and value. The figures given in "Whitaker's Almanac" for 1920, when things were becoming more normal, are also interesting.

Imports of pig products into the United Kingdom, 1920:—

	Cwts.	Value.
Bacon	5,611,630	£50,367,469
Hams	324,351	2,971,781
Lard	1,446,500	12,793,129
Total	7,382,481	£66,132,379

These figures show plainly enough what scope we have for developing an export trade. A liberal estimate of the number of pigs required for bacon purposes for the local trade and for export to adjacent territories can be put down at a figure approximating to 10,000 pigs per annum.

Every farmer knows that the local market in its spasmodic movements may offer 4d. per lb. live weight for pigs, and it may offer more

or even less, and the only means by which the price may be stabilised is to develop an export trade, the opportunity for which is indicated by the figures quoted. If we are to cater for local trade only, the pig industry, like the meat industry, must remain in a state of stagnation. Other countries, where the standard of labour and of living amongst the labouring masses is infinitely higher than that amongst the natives in this country, are able to compete successfully in the open markets of the world. Many of them, such as Denmark and Ireland, are compelled to import the bulk of their feeding materials, of which the largest proportion is maize. Rhodesia and South Africa generally therefore stand in the peculiar position of growing the raw product which they omit to manufacture into the finished article, although possessing advantages of climate, of cheap labour and land which their competitors do not possess.

There is absolutely no point, however, in deceiving or flattering ourselves that all we have to do is to put ham and bacon on the English market and that we can sell anything that we can produce. The history of the South African overseas beef trade disproves any such idea. To put the matter in a crude way, we shall have to push our competitors out and push ourselves in. As late comers in the markets of the world, our chances of success are remote unless we can supply articles of the very first class, and keep up a regular and constant flow to the great markets overseas.

The variations and vagaries of the price of pigs make the average farmer hesitate before laying out his capital to provide building and equipment requisite and necessary to supply that steady demand and that never-ceasing stream of pigs essential to make our bacon factories a financial success. If, however, the farmer realises where he stands, and that there is as stable a price for pig products as for butter, it should not be long before he is turning out the necessary supply. He must understand, however, that it is the quality as well as the quantity which counts, as no bacon curer in the world can manufacture first-class bacon from third-class pigs.

The Bacon Pig.—The overseas trade demands the full or Wiltshire side. For this purpose we want a trim, well and evenly developed pig of good length, and of fair depth and thickness, weighing from 170 to 200 lbs. It should have well-filled hams, very trim and neat, tapering gradually to the hock, heavily muscled and firm. Any tendency to flabbiness or folds which is sometimes seen in this country is very undesirable. The shoulders should be light and smooth. A heavy shoulder means considerable waste, especially for our local trade. The heart girth should be good, and the forelegs set well apart, showing breadth of chest and every indication of a good constitution. The pig should be deep in the flank without a surplus of flabby loose fat. The skin should be clean, and the animal should show "quality," a term difficult to define, but summing up the general desirable qualities of trim, clear-cut appearance, with no sign of coarseness in the bone, skin and hair, and showing a placid but nevertheless alert, thrifty appearance.

Characteristics of the Berkshire Breed.—The head should be of medium size and the face broad, open and gracefully, but not excessively, dished. The jaw should be stout and prominent; a crooked or badly formed jaw is an imperfection. The neck should be short, with a well-developed crest in the case of boars. The ears should be erect, of medium size, and fringed with soft silky hair. Distinctly drooping ears, or ears hanging widely apart, are undesirable; a slight inclination forward of the ears is not objected to. The shoulders should be obliquely placed, and should not show up too prominently. The back should be of good length, showing a strong level top line. The ribs should be well sprung and let down in order to give good width and depth of body. The loin should be wide, level and strongly muscled, and the rump equally well developed in these characteristics, and, in addition, should be well rounded off. The hams should be plump, broad and well let down into the backs. This is one of the noted characteristics of Berkshires, as is also their compactness, which is the result of excellent depth and width combined with good length of body. The flanks, both fore and rear, should be deep and well let down, so as to make a comparatively straight and trim underline, running parallel to the top line. The legs and feet should be short, straight, and set not only well under the body, but also wide apart. The pasterns should be medium in length and fairly straight. Long sloping pasterns are indicative of weakness and are undesirable. The hoofs or cloves should be closely knit, not spreading, and of good texture. The gait should be comparatively free and of medium length. In udder development, the Berkshire sow is on the average only fair. More often than not, only five pairs of teats are found, and not infrequently all of these are not fully developed, a fact which is no doubt due to the high degree of condition that gilts and brood sows are prone to take on if injudiciously fed and improperly managed. Berkshires are noted for their excellent quality, which may be seen in their fine bone, clean-cut joints, general refinement of head and fine coat of soft hair, firmness of fleshing, trim underline and smoothness and symmetry throughout. It is not uncommon to find good specimens of the breed dressing 85 per cent. of carcase to live weight. In size the Berkshire may be considered as intermediate between the Large Yorkshire and Middle White. Good average weights of mature Berkshire boars and sows to-day would be approximately 600 and 450 lbs. respectively.

Standard of Excellence for Berkshire Pigs.

Colour.—Black, with white on face, feet and tip of tail.

Skin.—Fine, and free from wrinkles.

Hair.—Long, fine and plentiful.

Head.—Moderately short, face dished, snout broad; and wide between the eyes and ears.

Ears.—Fairly large, carried erect or slightly inclined forward, and fringed with fine hair.

Neck.—Medium length, evenly set on shoulders; jowl full and not heavy.

Shoulders.—Fine and well sloped backwards; free from coarseness.

Back.—Long and straight, ribs well sprung, sides deep.

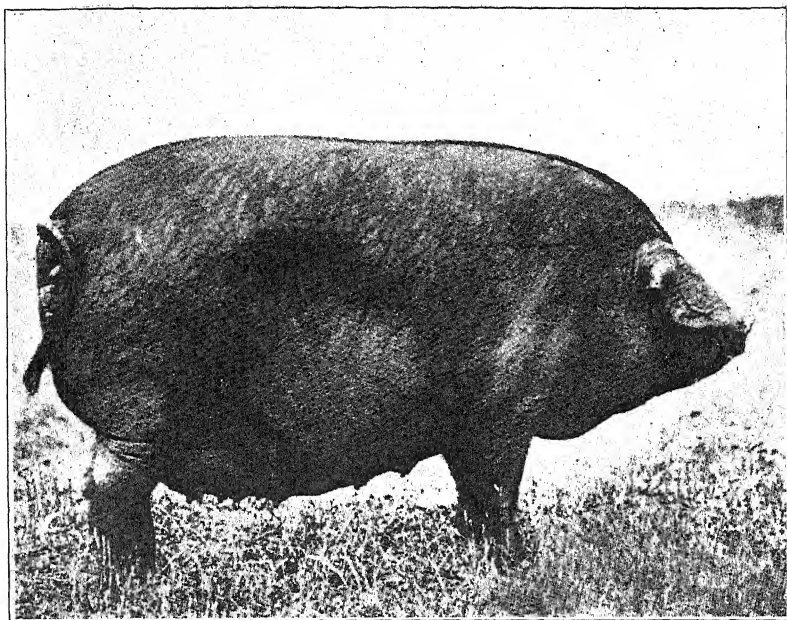


Fig. 1. Large Black Sow.

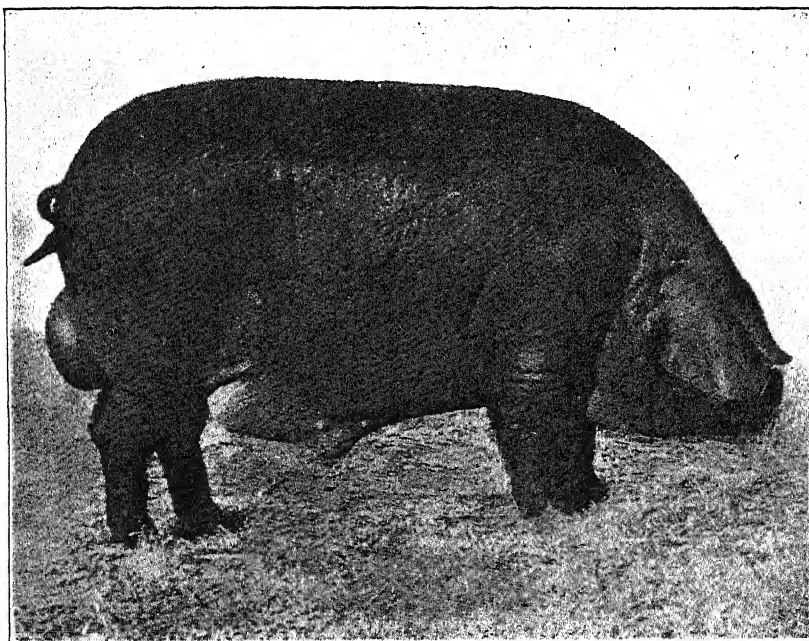


Fig. 2. Large Black Boar.

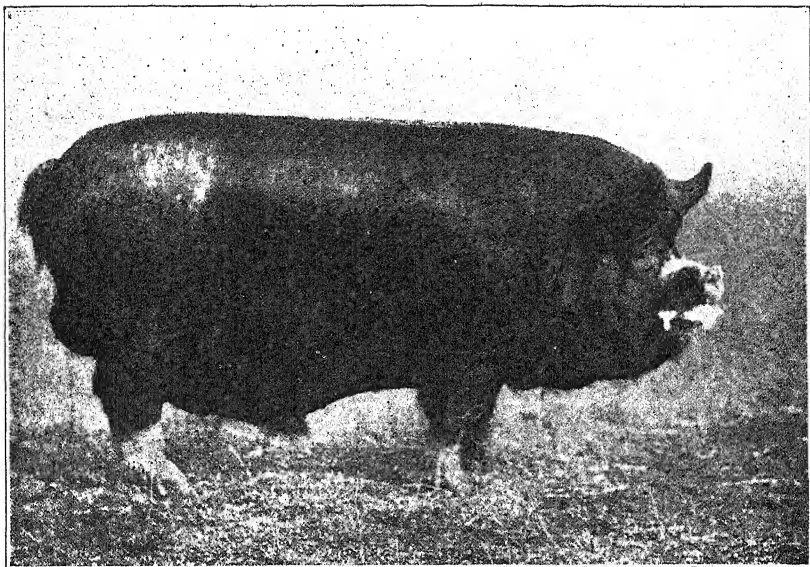


Fig 3. Berkshire Boar.

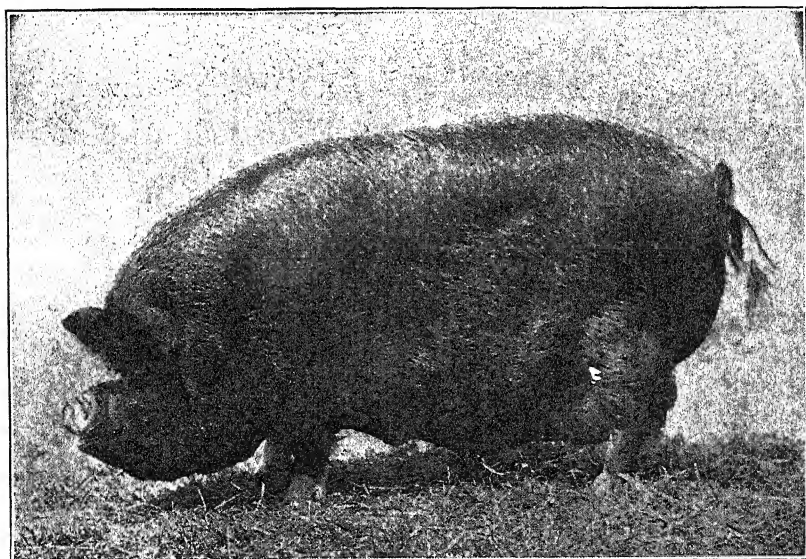


Fig. 4. Berkshire Sow.

Hams.—Wide and deep to hocks.

Tail.—Set high, and fairly large.

Flank.—Deep and well let down, and making straight underline.

Legs and Feet.—Short, straight and strong, set wide apart, and hoofs nearly erect.

IMPERFECTIONS :—

A crooked jaw.

White or sandy spots, or white skin on the body.

A very coarse mane, or inbent knees.

STRONG OBJECTIONS :—

A perfectly black face, foot or tail.

White on the outside of ear.

A rose back.

Large Black Pig.—*Characteristics of the Breed.*—The head should be of medium length and the snout ordinarily straight. The ears should be long, thin, soft and shapely, with good width between them at the poll. The jaw should be of medium size and the neck muscular and of good length. The chest should be deep and of medium width and the shoulders obliquely placed, blending well with the chine and fore-ribs to form a neat smooth shoulder top. The crops should be full, the ribs well sprung—not excessively wide—and well let down to give the required heart-girth, indicating constitutional vigour. The back should be of good length, medium width, and slightly arched at the loin and fore part of the rump.

The sides should be long and of medium depth, well let down in both fore and rear flank, and the ribs well sprung. The loin should be of medium width, strongly muscled and appreciably arched. The rump should be equally well muscled, of medium width and rounding out well, not sharply dubbed off. The hams should be firm, plump and let down well into the hocks. The twist should be deep and devoid of prominent fat pockets, especially in the case of gilts and sows, as these are often found in poor milkers and equally poor breeders. The tail should be large, prominently set, and moderately high placed in order to allow of as large a development of ham as possible. The legs should be well set under the body, strong and show plenty of bone. The pasterns should be of medium length, and strong to ensure the animal standing well on its feet, and the two cloves of each foot should be closely knit. Wrinkles, if pronounced, are undesirable, especially in young boars and gilts. The underline should be comparatively trim. In the case of sows there should be at least half-a-dozen pairs of well-developed teats; not infrequently seven pairs will be found, particularly in sows that come from prolific families.

In the case of both gilts and sows any tendency to masculinity is undesirable, as females of this type are often lacking in prolificacy or fecundity.

In the case of boars it is equally important to have them decidedly masculine, though not at the expense of quality. A medium coat of soft, straight hair is most desirable.

Large Black Pigs: Scale of Points.

	Pts.
<i>Head</i> .—Medium length and wide between the ears	5
<i>Ears</i> .—Long, thin, inclined well over face, nose medium length ...	4
<i>Jowl</i> .—Medium size	3
<i>Neck</i> .—Fairly long, muscular	3
<i>Chest</i> .—Wide, deep	3
<i>Shoulders</i> .—Well developed in line with ribs	8
<i>Back</i> .—Long and level	15
<i>Ribs</i> .—Well sprung	5
<i>Loin</i> .—Broad	5
<i>Sides</i> .—Very deep	8
<i>Belly and Flank</i> .—Thick, well developed	7
<i>Quarters</i> .—Long, wide, not drooping	8
<i>Hams</i> .—Large, well filled hocks	10
<i>Tail</i> .—Set high, moderate size	3
<i>Legs</i> .—Short, straight, flat, strong	5
<i>Skin and Coat</i> .—Fine and soft, moderate quantity of straight silky hair	8
	100

OBJECTIONS:—

Head.—Narrow forehead or dished nose.*Ears*.—Thick, coarse or pricked.*Coat*.—Coarse or curly, with rose; bristly mane.*Skin*.—Wrinkled.

DISQUALIFICATION:—

Colour.—Any other than pure black.

Characteristics of the Tamworth Breed.—The Tamworth is essentially a bacon breed, and holds the premier position for size among present day breeds. Mature boars will average fully 600 lbs., and mature sows about 150 lbs. less. According to the British standard, the Tamworth should have "Golden red hair on a flesh coloured skin, free from black." However, considerable variation in colour exists. As a rule, the young are of a light golden colour, darkening with age to almost a dull black very often. In conformation, the Tamworth may be described as being rather long and straight in the snout, with practically no dish in the face; ears long, thin, erect, falling slightly forward, and bordered with soft, fine hair; jowl, exceptionally light; neck, fairly long and thin; shoulder, inclined to be sharp; back and loin, slightly arched, of medium width; side, of medium depth, but very good in length; quarters and thighs of medium size, often poor, quality good and well suited for bacon purposes; temperament, decidedly active and good foragers.

*Standard of Excellence for Tamworth Pigs.**Colour*.—Golden red hair, free from black.*Head*.—Fairly long, snout moderately long and quite straight, face slightly dished, wide between ears.

Ears.—Rather large, with fine fringe, carried rigid and inclined slightly forward.

Neck.—Fairly long and muscular, especially in boar.

Chest.—Wide and deep.

Shoulders.—Fine and slanting.

Legs.—Strong and shapely, with plenty of bone and set well outside body.

Pasterns.—Strong and sloping.

Feet.—Strong and of fair size.

Back.—Long and straight.

Loin.—Strong and broad.

Tail.—Set on high and well tasselled.

Ribs.—Well sprung and extending well up to flank.

Sides.—Long and deep.

Belly.—Straight underline, and in sow a fair number of teats evenly placed.

Flank.—Full and well let down.

Quarters.—Long, wide, and straight from hip to tail.

Hams.—Broad and full, well let down to hocks.

Coat.—Abundant, long, straight, and fine.

Action.—Firm and free.

OBJECTIONS :—

Black hair, very light or ginger hair, curly coat, coarse mane, black spots on skin, slouch or drooping ears, short or turned up snout, heavy shoulders, wrinkled skin, inbent knees, hollowness at back of shoulders.

Characteristics of the Yorkshire Breed (*Large, Middle and Small Whites*).—The Yorkshire breed was known as far back as the 18th century. Since that time many improvements have been made, and three distinct types have been evolved, viz. : Large, Middle and Small Whites.

The Large White is easily the most prominent of these three types, and, like the Tamworth, is one of the largest of our modern breeds. Weights of 800 lbs. are often obtained, but a fair average would be 600 lbs. for boars and 450 for sows. In colour they are pure white, with occasionally a few blue skin spots, which are objected to but do not necessarily constitute a disqualification. Any other colour but white in the hair is ordinarily considered a disqualification, as is also too much dark spotting on the skin.

The conformation may be described as follows:—Body long, with good depth and medium width; head broad between eyes; sides long and neatly filled in both over the shoulder and loin; underline straight and trim; snout, medium length and fairly well turned up; ears medium size, erect and with inclination to fall forward; jaw very light; neck of good length and fairly thin.

The Large Yorkshires are specially noted for the excellent quality of the bacon they produce. The sows are prolific, good milkers and docile mothers, while the boars are noted for their prepotency. They have

been criticised as slow growers. Like the Tamworth, they are a trifle late in maturing when compared with the strictly lard breeds, but they have demonstrated that they can produce pork economically and of the finest quality.

The Middle White is smaller and of distinctly lard type. It is similar in colour to the Large White, but the face is excessively dished. Representatives of the breed have been imported into South Africa of recent years, and the breed is becoming increasingly popular in Natal.

The Small White is generally considered the smallest of our recognised pure breeds. They are typically lard in type, white in colour, with erect ears, very dished face, and are extremely low set and compact.

Standard of Excellence for Middle White Pigs.

Character.—Symmetrical, smart and typical, showing evidence of careful breeding.

Head.—Moderately short, face dished, snout broad and turned up, not too heavy in jaw and wide between ears. Ears fairly large, inclined slightly forwards and outwards, and fringed with fine hair.

Neck.—Medium length, proportionately full to the shoulders.

Chest.—Wide and deep.

Shoulders.—Sloping. Level across the top, moderately wide and free from coarseness.

Legs.—Straight and well set, with a sufficiency of flat bone of good quality.

Pasterns.—Short and springy.

Feet.—Strong, neat and even.

Action.—Firm and free.

Back.—Long and level from neck to rump.

Loin.—Strong and full.

Tail.—Set high, moderately long, but not coarse, with tassel of fine hair.

Hams.—Broad, full and deep to hocks.

Sides.—Deep and level.

Ribs.—Well sprung.

Belly.—Full, but not flabby, with straight underline and a sufficiency of well placed, sound teats.

Flank.—Thick and well let down.

Quarters.—Long and wide.

Coat.—Plentiful and of fine quality.

Skin.—Fine, and free from wrinkles and blue or black spots.

STRONG OBJECTIONS:—

Inbent knees, coarse mane, crooked jaw.

OBJECTIONS:—

Black or blue spots, wrinkled skin.

Cross-bred Pigs for Bacon Production.—Although all the breeds of pigs enumerated above have their good points, yet in actual practice, under South African conditions, it is found that the cross-bred pig

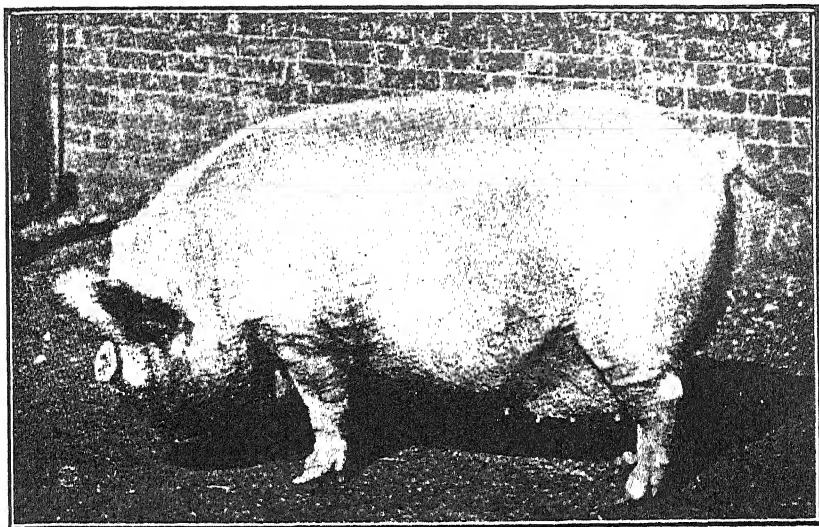


Fig. 5. Middle White Yorkshire Sow.
[From *British Live Stock*.]

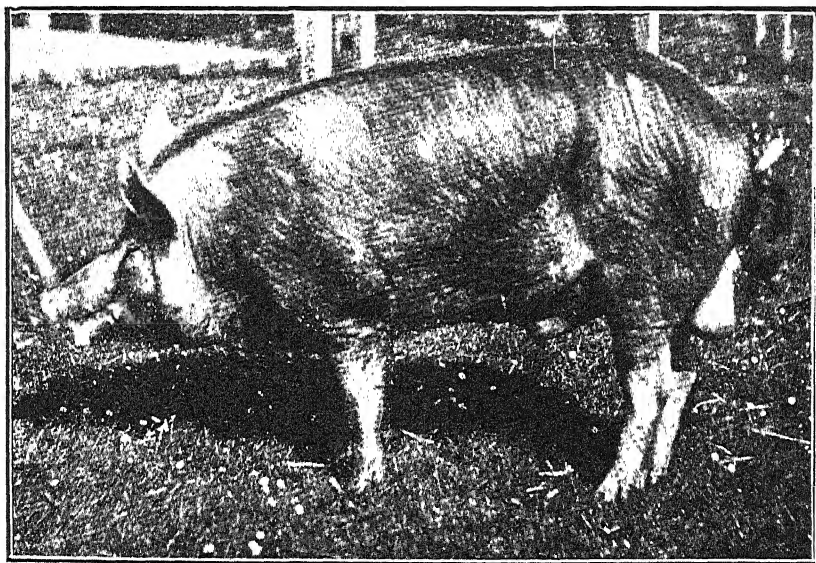


Fig. 6. Tamworth Boar.
[From *British Live Stock*.]

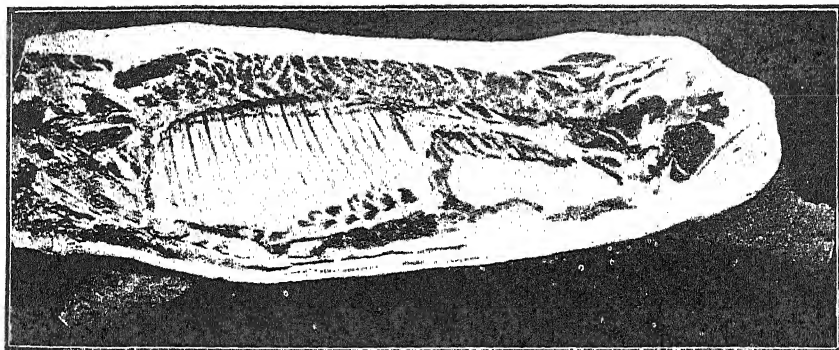


Fig. 7. Wiltshire side. Note the even admixture of fat and lean meat, also the uniformity and depth of layer of fat— $1\frac{1}{2}$ to 2 in.—along the back from end to end of side.

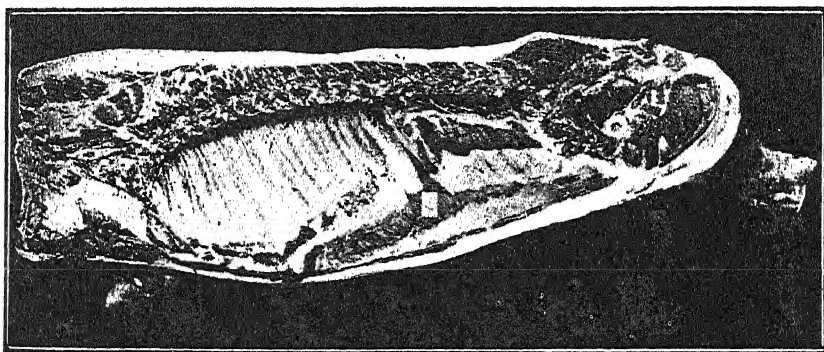


Fig. 8. Side of unfinished bacon pig. Note the undue leanness, also the shallowness of layer of fat— $\frac{3}{4}$ to 1 in.—along the back, and thinness of cut on the lower side.

[From *Swine Husbandry in Canada*.



Fig. 9. Side too thick and fat. Note the excessive depth of fat— $2\frac{1}{2}$ to 3 in.
—along the back.

produces the pig which approaches more nearly to the standard laid down as the ideal bacon type. There is little doubt but that for the overseas trade the white pig would be preferable, if only for its superior appearance as a finished product; but in actual practice the white pig is not popular, owing to its liability to sunscald.

Whilst some breeders prefer the Middle White boar, some the Berkshire and a few the Tamworth, it is generally conceded that the Large Black sow crossed with any of the above gives the best and most satisfactory results.

The Choice of the Boar.—Whatever the breed favoured as a sire, the animal should be pure bred. It is an unfortunate fact that a certificate of birth is not always a certificate of merit, and therefore the would-be breeder should always inspect the sire and dam of the animal he desires to buy, and if possible the grand-sire and grand-dam. It is necessary that the boar should come from an even large litter. The ability to get large litters is a hereditary trait, and for profitable pig-breeding large litters are essential. Large size is not always a good feature in a boar. A very large heavy boar often proves to be slow, and his litters are few in number, with a large proportion of weaklings. The boar chosen should possess masculine characteristics in a marked degree. He should be rugged in appearance, but not betraying such coarseness as will indicate a bad doer. Heaviness in the hind-quarters and lightness in the fore-quarters are most desirable features. Above all, he should be a good example of the breed he represents.

The Choice of the Sow.—Before choosing a sow, enquiries should be made as to the prolificacy of the strain. Ability to give large litters, and to maintain a good flow of milk is more a matter of family trait than of breed characteristic. The sow should be docile and contented. A sow of a wild roving disposition, which is constantly trying to open gates or break down fences, is not only a nuisance in this respect, but is generally a bad mother, whose offspring will probably inherit the roving tendencies of their dam. We want a sow preferably pure bred, true to type, with plenty of depth and breadth, with at least twelve evenly placed teats. The sow must be roomy, with plenty of width between the pelvic bones. Her skin should be clear, her hair fine, and she should possess that general indication of good health and thriftiness which is summed up in the word "quality."

Care of Breeding Stock.—Breeding stock must at all times be kept in a healthy condition, and neglect to provide sufficient exercise has always a deteriorating effect on the litter. Small camps or paddocks are essential to give the pigs, especially breeding sows, sufficient exercise, especially when they are in pig or are suckling their young. Shade and a wallow are both very essential.

The boar should have a small paddock into which his pen opens, so that he can run and root to his heart's content. This will afford him both exercise and amusement, and will tend to keep him from getting too fat and heavy. It is a mistake to mate pigs which are under ten months old. The offspring from immature parents is

generally most unsatisfactory, and if the sow farrows down when less than a year old she as a rule gets a setback from which she seldom recovers.

Management of the Sow.—The gestation period is approximately 112 days or 16 weeks, and a fortnight or more before farrowing the sow should be put into a warm comfortable breeding pen with a run attached. There should not be too much bedding, as the young pigs are apt to be smothered or get lost in the litter. The pig before farrowing should be fed on some separated milk, a handful of ground nuts and mealie meal, and a good supply of succulent food, such as sweet potatoes or pumpkins. This feed will stimulate milk secretion. It is important at this time to keep the bowels well open, and the addition of a little crushed and scalded linseed will have the desired effect.

When farrowing most old sows require no help at all, but young sows with their first litter often require assistance. Difficult presentations are commoner than is generally imagined, and many a good sow and litter have been lost for the want of a little attention at farrowing. Should the sow during farrowing become excited and turn on her offspring, take them away and do not return them until she has ceased farrowing and has quieted down. Sometimes the sow has more young ones than she has teats, and it is perhaps better to kill off the young weaklings which are in excess of the ten or at most twelve piglings which a sow can rear comfortably. See that the piglings get as much milk as possible from the teats, and should the udder be hard and swollen, as it sometimes is, foment with warm water.

The Care of the Young Pigs.—At about three weeks old young pigs begin to gnaw grain and other foodstuffs. The suckling sow should be given a small quantity of green stuff as well as maize meal in the form of a wash and separated milk. This is good both for the sow and the piglets. The young pigs will grow rapidly, and the mother's milk will hardly be able to supply the demands made by her family. They will soon be able to help themselves to the separated milk and maize meal, and it is a good practice to have a small trough specially reserved for their use behind an arrangement of rails, so placed in the corner of the sty that the young pigs can creep through and yet the sow can be excluded. (See illustration of pig creep.) It is very important to see that the young pigs do not fall off in condition, as a steady increase in size and weight at this stage is most important. The young boars should be castrated at about four weeks old.

When the young pigs are weaned at about seven to eight weeks no sudden change should be made in the dietary, of which at this time separated milk should be a prominent feature. Mealie meal in small quantities should be fed in the form of a wash.

The Feeding of Weaners.—After the pigs are weaned, food fed in the form of a wash with separated milk should be given. Mealie meal which has been well soaked is extensively used in this country, but if a little bran can be added the results will be more satisfactory. The

weaners should be fed at least three times a day, and it is most important that the feeding-troughs be kept sweet and clean. Fermenting food in the trough will cause digestive ailments, and this in turn will give the pigs a setback from which it will be difficult for them to recover. It should be remembered that the pig's life is short, and any setback which it may get will require a considerable time and feed for recovery. This is dead loss so far as the pig breeder is concerned, besides which a pig stunted by digestive troubles early in life never grows out to the same degree as one which has thrived steadily and put on weight from birth.

(*To be continued.*)

Tobacco Seed Beds.

The following inscriptions should have been printed with the plates which appeared with Mr. H. W. Taylor's article in the last issue of the *Journal*:—

Plate I.—Seed bed construction (sliding sashes both ways); kind of canvas used at night. (From Bulletin No. 21, Dominion Department of Agriculture, Ottawa, Canada.)

Plate II.—Tobacco seed beds, British South Africa Co.'s Marandellas Estate. (Photo by Mr. J. S. Loosley.)

Plate III.—Damping off. (From Bulletin No. 237, Agricultural Experiment Station of the University of Wisconsin.)

Plate IV.—Symptoms of wildfire: A. Infection of four days, showing typical halo spots with pinhead centres; B. Multiple infections coalescing and causing distortion of leaf; C. Typical infection of leaf in field seven days after heavy rain. (From Bulletin No. 203, Department of Botany, Massachusetts Experiment Station.)

Plate V.—A. A tobacco leaf showing an early stage of the angular leaf spot; B. Angular leaf spots on a tobacco leaf, about natural size. (From *Journal of Agricultural Research*, vol. xvi., No. 8.)

Weirs and their Construction.

By A. C. JENNINGS, Assoc.M.Inst.C.E., A.M.I.E.E., Government
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One of the most important features of any scheme either for irrigation or power which involves the diversion of water from a river is the construction of a suitable intake weir. In certain cases where a canal is supplied from a storage reservoir, no headworks are required, but in other cases where it is led straight from a river some such works are essential.

In this country it is common to refer to any wall built across a river as a "dam," but there is a distinct difference between a dam constructed for storage purposes and a diversion weir, except when the latter, as is sometimes the case, is used for storage, in which case it is called a storage weir.

The weirs which it is proposed to describe here will be of the low "diversion type," constructed primarily for raising the level of a stream or river and affording convenient means of controlling or diverting the stream flow into a canal or aqueduct. Weir structures are of many types, and their design is largely influenced by the nature of the foundation upon which they are to be constructed. They can, however, be classified generally under the following three main heads:—

- (1) Temporary types,
- (2) Semi-permanent types,
- (3) Permanent types,

and these can be further sub-divided into—

- (A) Temporary types on unstable foundations,
- (B) Semi-permanent types on unstable foundations,
- (C) Permanent types on unstable foundations,
- (D) Permanent types on stable foundations.

It would not be possible in an article of this nature to deal exhaustively with each of these types, but a brief description will be given sufficient to enable anyone contemplating such works to decide the most suitable type for any particular site or foundation. It may be mentioned that the expression "semi-permanent" does not imply that it is a structure liable to be washed away or destroyed and hence not permanent, but rather that the materials of which it is constructed are themselves perishable and may require renewals from time to time.

(A) **Temporary Types on Unstable Foundations.**—Under this heading may be considered any temporary structure placed in a river for the purpose of diverting water.

Weirs of a purely temporary type are usually only justified as a provisional measure until conditions warrant something more permanent being erected, or in cases where foundations are unobtainable and the annual cost of replacement would be less than the annual charges on a more permanent structure.

(A) 1. *Dry Stone Weir.*—A heap of loose boulders thrown across a stream often affords a temporary diversion, and while liable to wash away each flood season, their use is sometimes justified until such time as a better structure can be erected.

(A) 2. *Boulder Brushwood Weir.*—This consists of a heap of stones carefully placed by hand, with large branches of trees laid with their crowns upstream uniformly between successive layers of stones. This type was commonly used at one time in the Cape Colony, and a certain amount of skill was often shown in their construction, so that they withstood considerable floods passing over them before washing away. Weirs of this type were often built to heights of six feet above the level of the river bed, and by placing grass sods and straw stable manure between the stones on the upstream side they became reasonably watertight.

(B) **Semi-permanent Types on Unstable Foundations.**—The erection of a permanent weir on an unstable foundation is often a matter of considerable difficulty and expense, so that a structure which is not entirely of a permanent nature is often justified. The types now to be described, while being more permanent than the foregoing, are still not entirely so, and may require repairs at intervals.

(B) 1. *Stone and Wire Net Weirs.*—In certain rivers having sand and boulder beds, and where foundations are not easily obtainable, and it is only required to raise the water level two or three feet, a dry stone weir as shown in figure 1 is sometimes suitable.

This weir consists of large stones secured in heavy wire nets. These stone filled wire nets are made up in the form of "sausages" or "bolsters," and can be arranged in any convenient manner. In the illustration the structure consists of four such nets; the lower one, "(a)," being placed below the river bed to form a cut off or prevent underscour; the upper one, "(b)," forming the main wall; and "(c)" and "(d)" placed level with the river bed to form a downstream apron. The nets are woven of No. 8 or No. 10 (S.W.G.) galvanised iron wire in any convenient length or width as shown in figure 2, and where a very wide net is required two can be fixed together.

In constructing a weir of this kind each bolster is contained in a separate net; thus in making (say) the portion (b) the net will be about 13 feet wide, that is of sufficient width to wrap round the whole of the stones and allow about six inches for overlap.

In constructing the work the wire net is first laid in place right across the river and the stones neatly arranged to the desired section

on top of same, and when completed the net is folded completely round the stones, overlapped and secured together as shown in figure 3. The size of stones can be anything from four inches diameter upwards.

This type of weir after a certain length of time often becomes nearly watertight, or sufficiently so to enable a large portion of the stream flow to be diverted into the canal. Its watertightness can be improved by placing a clay blanket on the river bed for about 20 feet on the upstream side, and also placing a clay or rubble fill against the main wall (b) as shown. The length of the downstream apron which is provided to take the overflow should be not less than eight feet, and for weirs higher than three feet increased proportionately; but this type is not recommended for heights of more than four or five feet above stream bed. A feature of this weir is that the stone and wire bolsters readily adapt themselves to any settlement which occurs, and repairs can be easily effected.

The stone bolsters should be carried well into the banks to obviate outflanking, and where necessary suitable flank protection must be provided.

(B) 2. *Crate Weirs*.—These are in many respects similar to crib weirs so commonly used in America and other countries where timber is plentiful. The latter consist of cribs formed of logs and filled with stone, the whole being built *in situ* and faced with planks, while the crate weirs are formed of a number of separate crates in the manner to be described. This type of weir is effective, and probably one of the best of the semi-permanent structures, and is very suitable for many rivers where a solid built weir would be out of the question. On many schemes the weir is seldom required more than about six feet in height, and as this type is not recommended for greater heights than seven feet, it will in many cases be found adaptable.

In figure 4 is given a cross section showing the general arrangement of the crates in a six feet weir. For structures of different heights the dimensions of the crates can be modified, but it will usually be found better to retain the height and breadth of crate as shown in figure 6, and simply vary the length. The crates can be constructed with suitable native bush poles, wood from thorn trees (*acacia karroo*) being very satisfactory. The design and construction of these weirs is very simple, as will be evident from figures 4 and 5.

In a flat sandy river where the water is usually spread fairly evenly across the bed, the foundation trench should be excavated and the lower crates laid uniformly across the river. This will entail a good deal of underwater work, but this is unavoidable, as with a loose sand bottom any attempt to divert the river to enable sections to be worked in the dry usually leads to large holes being scoured in the bed which ultimately have to be filled. After laying the lower crates they are hand packed with graded stones, of any size from three to twelve inches diameter, care being taken to fill all interstices as far as possible. The next layers of crates are in turn placed and filled with stones, the horizontal rails of adjacent crates, both vertically and horizontally,

being secured together with several lashings of No. 8 (S.W.G.) galvanized iron wire.

A long downstream apron having a slope of about one in fifteen is an essential part of weirs of this type, and in figure 4 this is shown constructed in stone and wire net work, although it might equally well have been constructed in stone filled crate work.

These nets will be placed and filled in the manner herein previously described, and should provide a very suitable flexible apron capable of withstanding the severest floods. The lower portion of the apron abuts on to a talus of crates, the length of which should be not less than eight feet. This latter is a very necessary feature of any weir of this type, its function being to check the momentum of the water leaving the apron and to give the flow a horizontal direction and obviating any tendency to scour at this point.

The main wall of this weir should be carried well into the banks, and the excavation carefully back filled with good hard material, well rammed. The stone and wire net work of the apron should be continued over the banks to afford protection against scour or outflanking.

Weirs of this type are in themselves not watertight structures, but it is surprising how rapidly they become silted and improve in this respect after construction. Where special watertightness is desired a clay blanket can be laid on the stream bed upstream, and a diaphragm of well tarred cocoanut matting placed immediately on the upstream face of the crates. This latter is secured to a horizontal rail fastened to the top of the crates, and is kept in place by the stone fill forming the upstream apron.

(C) Permanent Types on Unstable Foundations.—These types are not so frequently constructed in this country as the others described in this article. They are, however, commonly used in the large sand rivers in India, and it is remarkable the degree of security which has been obtained with comparatively high structures on porous foundations of pure sand. There are many designs for this type of weir, but their principal features consist of a main or cut off wall with long up and downstream aprons. The principle underlying their design is the resistance to the passage of water under the structure offered by the sand bed or permeable substratum upon which it rests. Thus if the velocity of travel is sufficiently reduced, percolation or undermining cannot occur.

Different sands and gravels have varying percolation factors, and the design of the structure, that is the length of aprons, is governed by this factor and the height of the main or weir wall. In figure 7 is shown a section of wall of this type which could be adopted in any situation of the nature described. It is not proposed here to describe the construction of such a weir in detail, as in cases where works of this type are necessary skilled advice should always be sought before undertaking the work.

(D) Permanent Types on Stable Foundations.—By a stable foundation is meant one consisting of solid rock or other material

sufficiently hard to become uncompressed with the weight of a structure, impervious to water, and able to withstand the scouring action of falling water to a moderate degree. Upon a foundation of this kind it is possible to construct a solid masonry or concrete wall of the overflow type, and of sufficient stability to withstand a flood of any magnitude over its crest. There are many forms of structure adapted to meet these conditions, but the most usual in the case of low weirs is that known as the gravity section wall, designed of sufficient base width and section to withstand overturning due to the weight of water.

In figures 8 and 9 are given cross sections of two walls of this type, the one constructed in mass concrete (cyclopean rubble), and the other with rubble masonry face work and concrete hearting. The weirs shown are six feet high above stream bed, and of sufficient dimensions to withstand a flood of six feet passing over their crest. On ordinary small schemes the type shown in figure 8a is perhaps the most suitable as requiring least skilled labour, and largely obviates the use of timber shuttering as in the case of the plain concrete type.

In carrying out the construction of a weir wall, care must be taken to excavate to a solid foundation throughout the river bed. It may not be always possible to secure the wall entirely on solid rock, and a good impervious clay or other hard material can sometimes be accepted. In such cases, however, the wall must be carried down to such a depth below the river bed as to obviate any possibility of under scour, and a downstream apron or water cushion will usually be required to prevent scouring out below the wall. Considerable discretion is often required in deciding upon the suitability of a foundation other than solid rock which has to carry a solid masonry or concrete wall.

Where the wall can be built entirely on solid rock little difficulty should be experienced, but all decomposed or loose rock must be removed, and fissures or crevices in the rock thoroughly cleaned out and filled with concrete or rich cement grout. The rock surface should be roughened and thoroughly cleaned before the concrete masonry is placed, a rich cement mortar (1—2) being applied immediately before the first concrete is laid.

If blasting is required in preparing the foundations, very small charges only must be used in order not to disturb the underlying rock.

In an appendix to this article are given specifications for the construction of masonry and plain concrete work which could be taken as a basis when entering into a contract for the construction of weirs of this kind.

In building concrete work in a river having a large permanent flow one of the greatest difficulties is to dispose of the water during construction. No general rules applicable in all cases can be laid down, as so much depends upon local conditions, but it is safe to say that the lowest part of the river bed should be tackled first. If the water can be diverted round the work by means of a coffer dam, as is often the case, the foundations of this portion should be placed and the wall

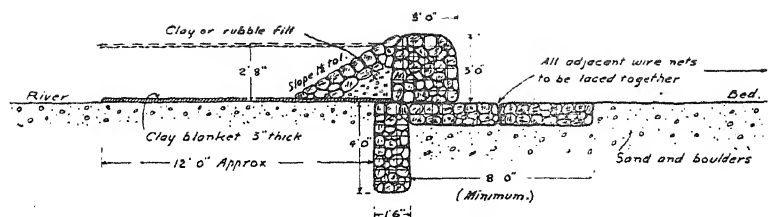


Fig. 1. CROSS SECTION OF STONE AND WIRE NET WEIR.

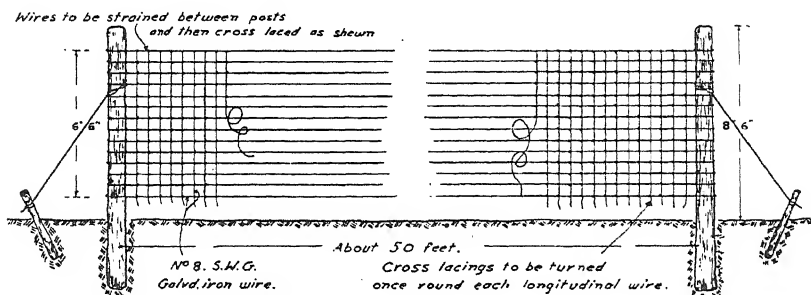


Fig. 2. METHOD OF MAKING WIRE NETS.

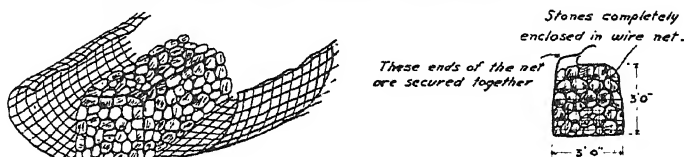
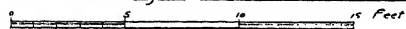


Fig. 3. METHOD OF WRAPPING STONES IN WIRE NET.



Scale Figs 1, 2, 3.

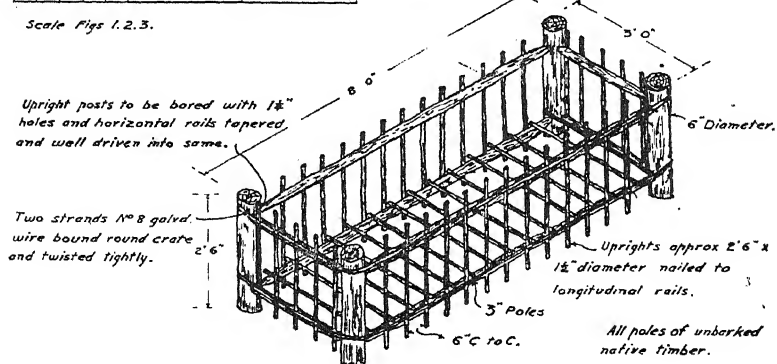


Fig. 6. TYPE OF CRATE.



Scale Fig 6.

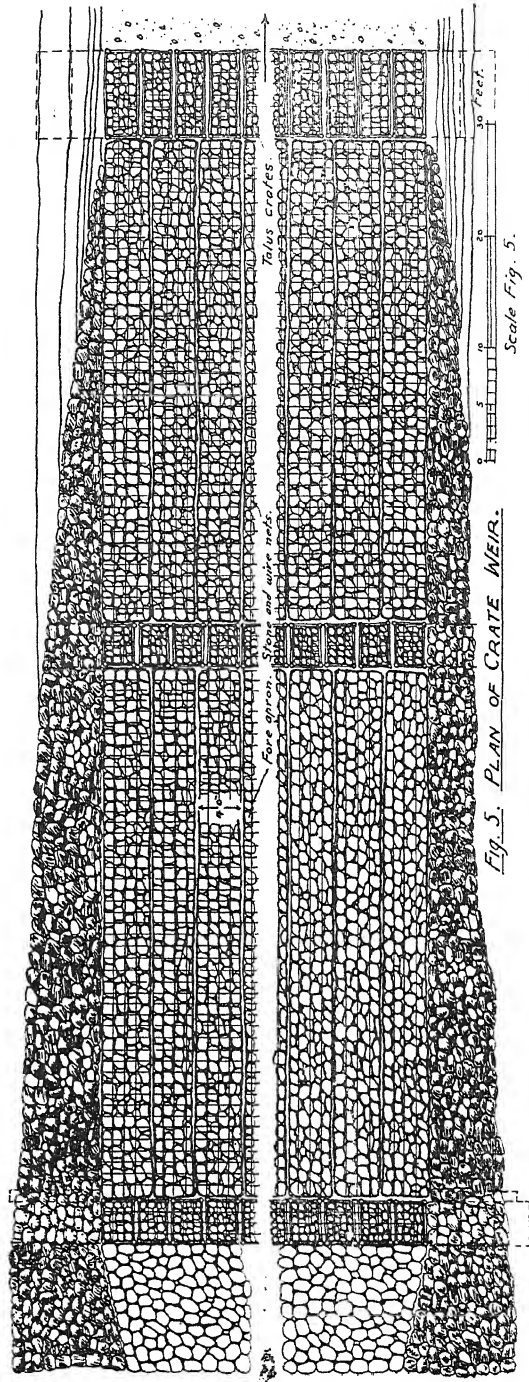
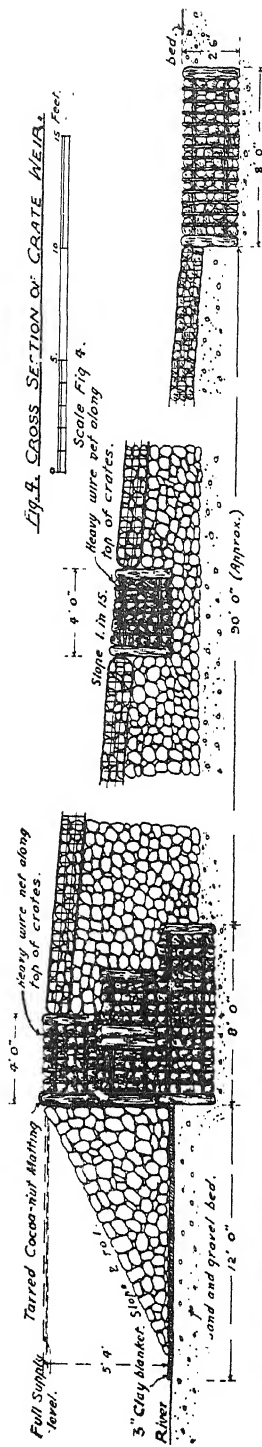


Diagram No. 2.

brought up to bed level. At this point sluice ways can usually be provided in the wall to discharge the river flow, and the water turned through these, and thus enable the remainder of the wall across the river to be completed in the "dry." The final closure of the sluice ways can be made by means of stop planks dropped into specially arranged grooves in the concrete on the upstream side, as shown in figure 10, and the gap in the wall filled in with concrete.

Overfall weirs higher than six feet constructed in rivers liable to very large floods will require special consideration and attention; the design and construction of works of this magnitude should not be undertaken without the assistance of skilled engineering advice.

APPENDIX.

STANDARD SPECIFICATIONS for rubble masonry and concrete used in the construction of Weir Walls.

RUBBLE MASONRY.

Stone.—The stone used must be the best available, and should be hard, close grained, tough and free from decomposition. In quarrying stone for building purposes, care must be taken that it does not become shattered or cracked during blasting operations. Granite quarried by fire will be permitted, providing the stone is hard and otherwise suitable. The stones used can be of any convenient size, but should not have a less dimension than four inches in their depth, and will be roughly dressed.

Cement.—The cement used shall be in good condition, and able to meet the requirements of the British standard specification.

Sand.—The sand used shall be clean and well graded, that is, neither too coarse nor too fine. It shall be free from any organic matter or harmful ingredients.

Cement Mortar.—The cement mortar used in the construction of the work shall be proportioned not inferior to—

- 1 part by volume cement,
- 4 parts by volume sand.

The ingredients shall first be measured in suitable measuring boxes on a mixing platform ten by ten feet, all joints in the boards being tight to prevent the escape of mortar. The cement and sand shall be first mixed and turned over three times in the dry state, then wetted gently by water from a rose can, and turned over again twice during the process of wetting. All cement mortar shall be used within fifteen minutes of being mixed. Mortar that has once partially set must not be re-tempered or used.

Setting Stones.—All stones must be laid on their natural bed, and must break joint both ways. The stones must be laid on a prepared bed of mortar with joints not greater than three-quarter inch, and all joint spaces well filled with mortar.

Masonry Facing of Weirs.—The masonry used in the facing of weir walls can be built to about two feet six inches in height, and when sufficiently set the concrete backing can be placed, and the next "lift" of masonry carried up.

Joints.—The interior joints will be raked out to bond with the concrete. The joints of the outer faces will be neatly struck, except where the surface is to be rendered, in which case the joints will be raked out as before.

Protection from Sun.—All work must be protected from the direct rays of the sun, and kept thoroughly wet by being covered with wet sacks or matting for at least seven days after being placed.

Use of Lime Mortar or Lime Admixture.—The use of lime mortar prepared from non-hydraulic lime will not be permitted. If specially approved, however, the substitution of 10 per cent. to 20 per cent. of lime paste for an equal quantity of cement paste can be adopted.

CEMENT CONCRETE.

Proportions.—The concrete used in the hearting of masonry faced weir walls or in the all-concrete structure shall be proportioned not inferior to 1—3—6, that is—

- 1 part by volume cement,
- 3 parts by volume sand,
- 6 parts by volume stone.

Cement.—The cement used shall be in good condition, and able to meet the requirements of the British standard specification.

Sand.—The sand used shall be clean and well graded, that is, neither too coarse nor too fine. It shall be free from any organic matter or harmful ingredients.

Stone.—The stone shall be clean, hard and broken to pass a two-and-a-quarter inch ring. Where stone is broken by a crusher the fine dust, if in excess, shall be removed before use.

Mixing Platform.—When mixed by hand a suitable large platform about twelve feet by twelve feet must be provided for mixing the concrete, and so arranged that no escape of mortar can occur.

Hand Mixing the Aggregates.—The sand and cement are first gauged in suitably proportioned boxes. They are then spread out on the mixing platform and thoroughly mixed together in the dry state. The stone, having been gauged in a suitable box, is spread out and well wetted, the cement-sand mixture is then incorporated with the stone, and the whole turned over together at least twice in the dry state; water from a rose can is then applied during the process of mixing, and the complete mixture is turned over a further three times.

Machine Mixing.—In machine mixed concrete the aggregates will be first measured in suitable receptacles before being placed in the machine, water being added during the process of mixing, which should occupy not less than one-and-a-half minutes.

Expanded metal reinforcement.
Concrete slabs $6 \times 6 \times 1$.

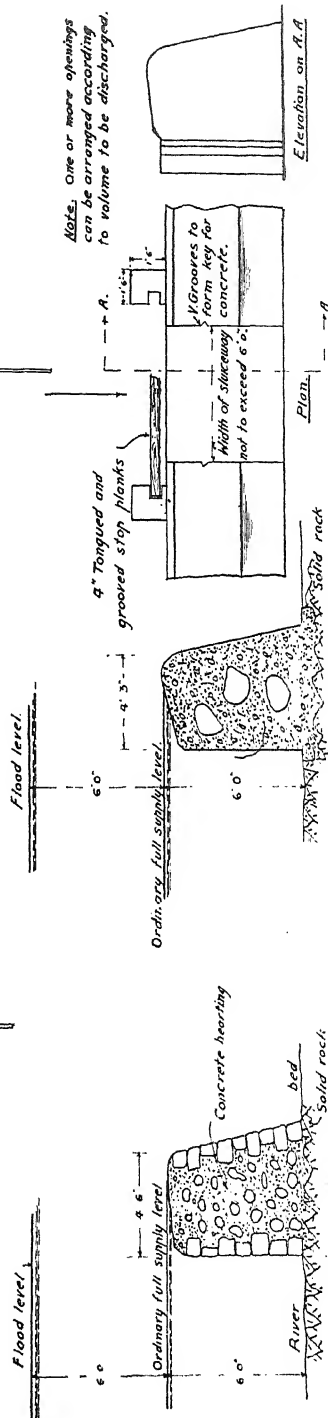
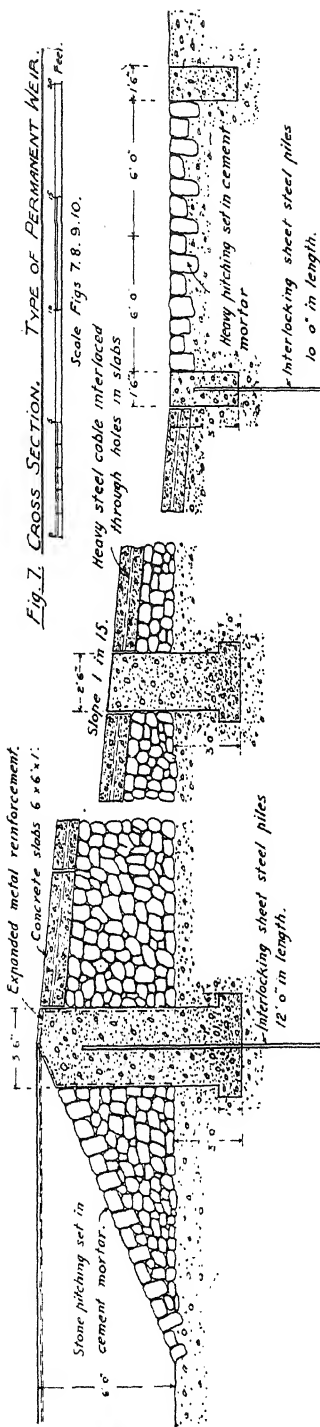


Fig. 9. WEIR WALL IN PLAN CONCRETE.
(CYCLOPEAN RUBBLE.) Fig. 10. OPENING IN WEIR WALL TO DISCHARGE
RIVER DURING CONSTRUCTION.

Diagram No. 3.

Water.—Only sufficient water to be added to produce a concrete of good flowability. On no account must the concrete be mixed into a "slushy" state.

Placing Concrete.—All concrete must be deposited in the work within fifteen minutes of mixing. Concrete that has become partially set must not be re-used.

Curing.—All concrete work must be kept thoroughly moist and protected from the direct rays of the sun for at least seven days after being placed.

Plums or Displacers.—At the same time as the concrete is placed large clean dry stones or boulders can be placed into the concrete mass. These stones must be carefully placed without touching one another, and must not be placed within six inches of the faces of the wall. Any quantity of such stones up to 30 per cent. of the volume of the structure can be thus placed.

Joining Old and New Work.—When new concrete has to be placed over a previous working, the surface of the latter must be well picked over and brushed with wire brushes to remove any laitance, and then well scoured with water. Immediately before the new concrete is placed the old surface should receive a coat of 1—2 cement sand grouting in order to ensure a good bond between them.

Placing Concrete under Water.—Concrete in weirs or dams should never be deposited under water except when circumstances render it absolutely necessary. In such cases the water in which it is placed must not be flowing, and the concrete placed by means of a tremie or other approved method. The concrete when once placed should not be disturbed in any way.

The Manufacture of Roofing Tiles on the Farm.

By ARTHUR J. ORNER.

The problem of a suitable roofing material is a serious one in Rhodesia, and one which has not as yet been satisfactorily solved. Corrugated iron is expensive and unsightly; it is hot in summer and cold in winter, and is noisy in rain or hail storms. Grass roofs are more expensive in the long run, and are an ever present source of fire danger. Probably the most satisfactory roofing, under the conditions which exist here, is tile, but unfortunately this excellent roofing material has never been used to any extent in this country, and many people are probably unaware of the fact that roofing tiles have ever been made and used successfully here.

In the American Board Mission, at Mount Silinda and Chikore, however, roofing tiles have been made and used for more than twenty-five years, and to-day all the permanent buildings of the mission are roofed with tiles. At Mount Silinda alone there are nearly fifty buildings, large and small, and in addition there are a number of privately-owned buildings in the district which are covered with tiles made by the mission.

At the present time all of the tiles are made by machine, and are of the interlocking type, something like the Marseilles tile which is imported into the country to some extent; but in the early days the tiles were made entirely by hand, using only such appliances as can be easily made by any farmer. Roofs covered with these tiles have given excellent satisfaction, and are, to all intents and purposes, as good to-day as they were when first laid twenty-five years ago. For tile-making on a small scale the hand-made shingle tile is entirely suitable, though for manufacturing on a larger scale it is simpler to use machinery and make interlocking tiles. This requires a much more expensive equipment, but it calls for less supervision and care, and a roof of interlocking tile is considerably lighter than one of shingle tile, which is an item worth consideration where timber is as scarce and expensive as in Rhodesia.

Manufacture of Hand-made Tiles.—In a general way the making of roofing tile is similar to the making of brick, with which every Rhodesian farmer is familiar, though of course far greater care is

Plan.

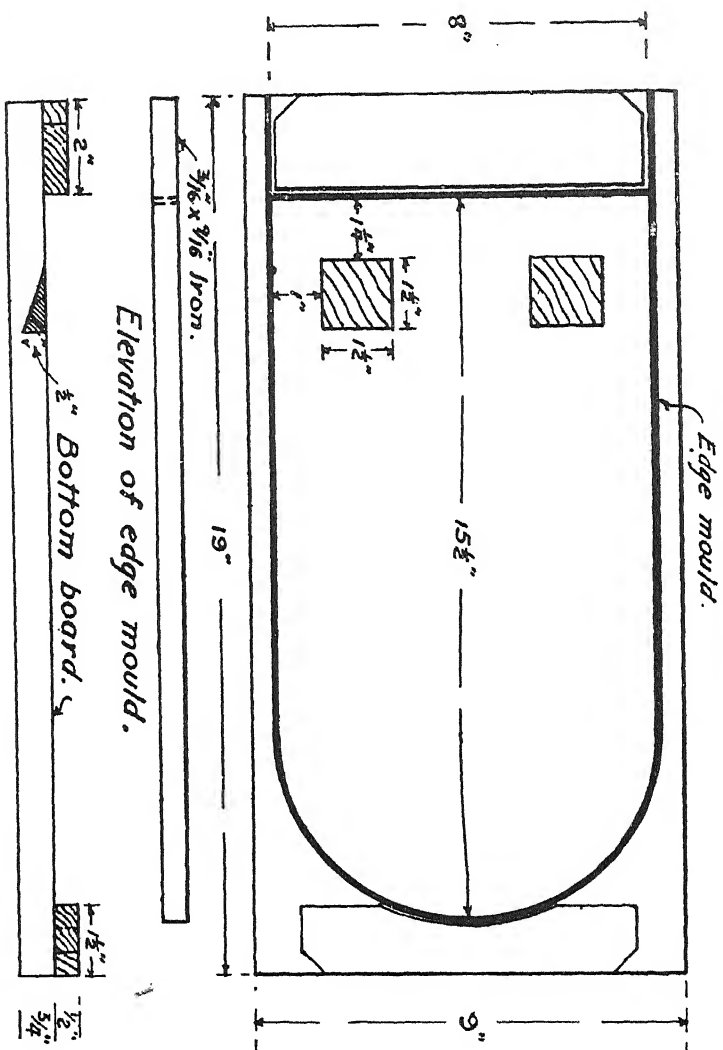


FIG. 1. MOULD FOR HAND MADE SHINGLE TILE.

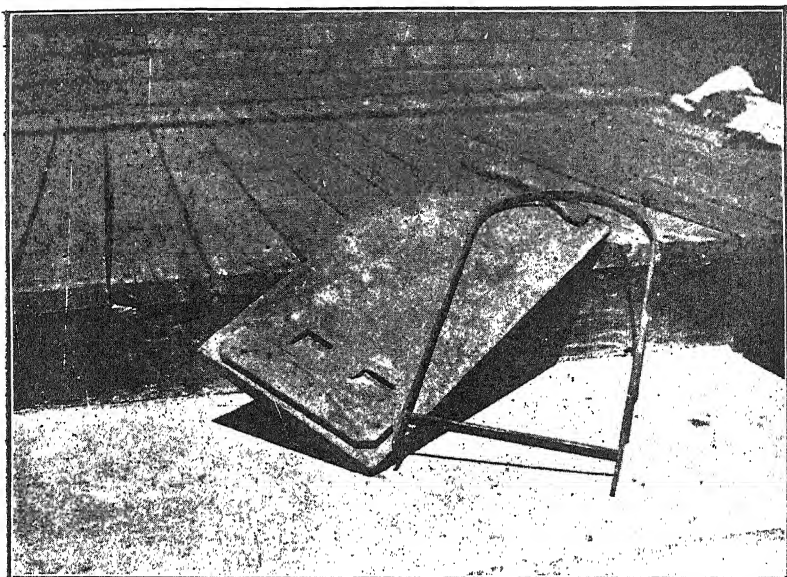


Fig. 2. Mould for Shingle Tile.

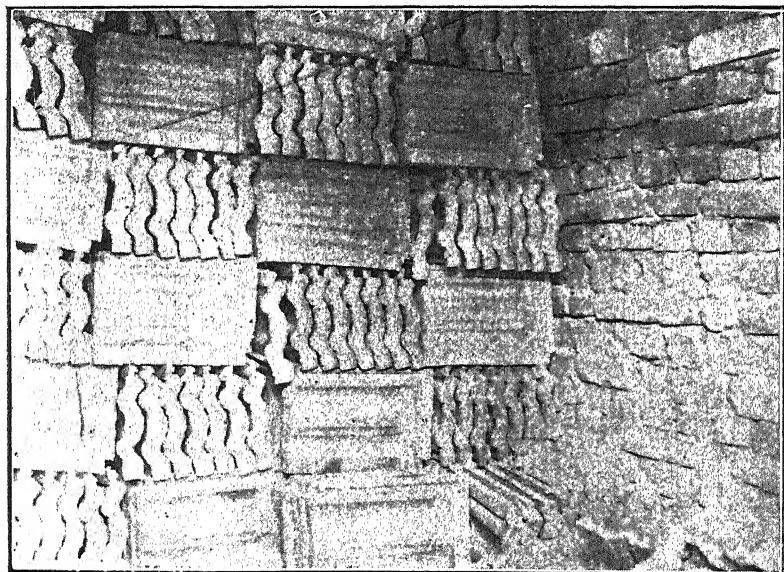


Fig. 3. Interlocking Tile packed in kiln.

required. The first consideration must be the matter of clay. Many soils and clays which will make quite satisfactory bricks are altogether worthless for tiles. Only good hard-burning clay is suitable for this work, and as a general rule it may be considered that any clay which the natives use for pot-making will be found satisfactory for tiles, and that clay which will not make pots will probably not be satisfactory for tiles. With some clays it will be found necessary to mix small quantities of sand to prevent undue breakage during drying.

The equipment required for the making of shingle tiles is simple in the extreme. Aside from the moulding table and other appliances used for making brick, the only requirements are four or five tile-moulds, as illustrated in figs. 1 and 2, which can be made by any farmer for two or three shillings each, and a shed in which to dry the tiles. The drawing indicates clearly the method of making the moulds. The size may of course be varied somewhat to meet the requirements or the whim of the individual, but care must be taken that the moulds are all uniform in size and that the iron used for the edge-mould be of uniform width, so that all tiles will be of the same thickness. It is not advisable to attempt making the tiles much larger than the size shown, as it will be too difficult to avoid warping and twisting both in drying and burning. A thickness of about half an inch is required for strength, a greater thickness than this adds unnecessarily to the weight of the roof and requires more timber in building.

Moulding and Drying.—When the moulds have been made, a gang of about eight or ten boys will be required if work is to be carried on with one moulder. The clay must be very thoroughly prepared, great care being taken to remove all stones or foreign substance of any kind. It is our practice to have it first tramped by oxen, and then it is thoroughly tramped by the boys just before it is taken to the moulding table. One boy is located at the moulding table to give the clay a final working before passing it on to the moulder. The clay should be mixed somewhat stiffer than for making slop-moulded bricks, as otherwise the tiles will get out of shape when first removed from the mould. When the clay has been thoroughly prepared the moulding may commence. The moulder takes one of the moulds and wets it thoroughly, then places the bottom board on the table before him. Next he lays carefully on top of this board a piece of ordinary white limbo which has been cut to the size of the board, the parts coming over the depressions for the lugs having been cut so that the limbo will lie flat in the lug cavities. This limbo is to assist in removing the tile from the mould, as otherwise it will stick to the board and be impossible to remove. Now the edge-mould is laid in place on top of the bottom board, and a portion of clay somewhat larger than is required for the tile is placed in the mould, care being taken not to disturb the limbo underneath. The clay is carefully forced into the lug cavities and up against the edges of the mould all around, then the surplus clay is cut off by sliding a square edged stick across the top of the mould. During this operation the mould is held in position on the moulding table by two cleats nailed on to the top of the table. Care must be taken to leave the top of the tile thus cut off as smooth.

as possible, as this is the side which will be uppermost on the roof. After roughly scraping off the surplus clay, it is best to wet the surface of the tile slightly with the hand dipped in water, and then to repeat the cutting process. This leaves a smooth glossy surface.

One of the other boys now takes the mould and tile to the drying ground, where the tile is to be removed from the mould. Having selected a place, the mould, still containing the tile, is quickly turned over and laid down bottom side up on the ground. The bottom board, now on top, is easily removed, leaving the tile lying, with the limbo and edge-mould, face down on the ground. The limbo is now carefully peeled off, being careful not to disturb the shape of the lugs, then lastly the iron edge-mould is lifted off. In case the tile tends to stick to this and to be lifted up, it may be loosened by carefully holding the tile down by one corner as the mould is lifted, at the same time giving the mould a slight lateral shaking motion to assist in separating it from the clay. As soon as the tiles have been moulded and laid on the drying ground they must be covered with a light layer of grass, especially if the sun is shining or the wind blowing, as they must not dry too rapidly or they will crack and warp.

Particular attention must be paid to the preparation of the drying ground, which should be near the moulding table. The surface on which the tiles are to be laid must be smooth and straight so that the tiles will not dry in a crooked shape; and it must be soft and free from lumps to allow for the motion of the tiles as they shrink in drying, as otherwise the strain will be too great and many will crack. If the surface of the ground under the tiles is too dry, it will cause too rapid drying of the tiles on the under side and consequent warping and breaking. A certain loss through breakage must be expected at this stage, however carefully the work may be done. This loss will vary from 10 per cent. up to as much as 30 or 40 per cent., or even more, in hot windy weather.

The tiles must remain on the drying ground until sufficiently dried so that they may be picked up and handled without danger of bending, the time varying from one to two, or even three days, according to the nature of the clay and the conditions of the ground and atmosphere. When they have reached this stage it is best to remove them to a thatch covered shed where they will be protected from the sun and wind. Here they are carefully placed on edge and left until thoroughly dry and ready to be burned. In order to avoid warping during this process the tiles should be packed as closely together as possible, placing them face to face in pairs and taking care that they stand upright and not leaning. This is very essential if they are to be kept straight. One of the greatest difficulties in making shingle tiles is to prevent warping and bending, and this must be borne in mind throughout the whole process. It is impossible to place too much emphasis on this point, as tiles which are not straight will not lie flat on the roof, and will cause leaking by allowing the rain to blow underneath. The making of tiles should be attempted only during the dry season, and preferably at a time when there are not likely to be frosts or strong winds, either of which are liable to crack large numbers of tiles.

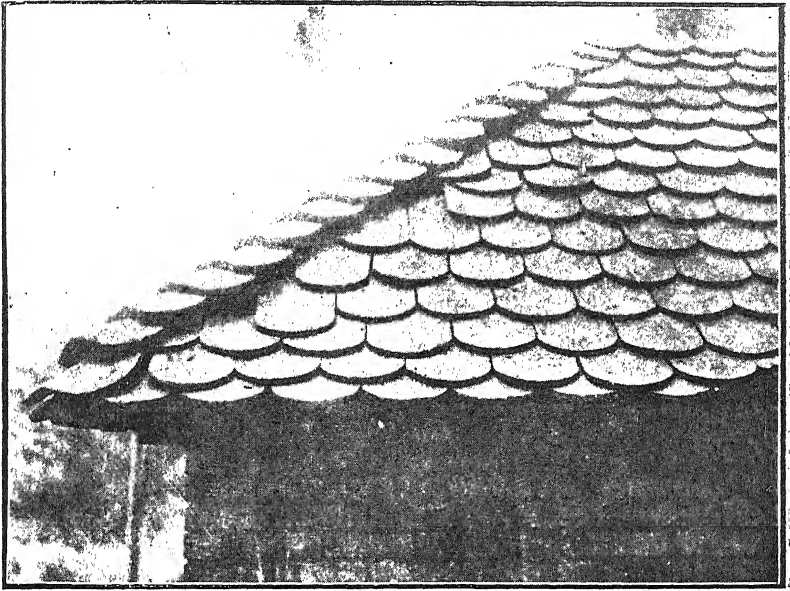


Fig. 4. Roof with Shingle Tiles.

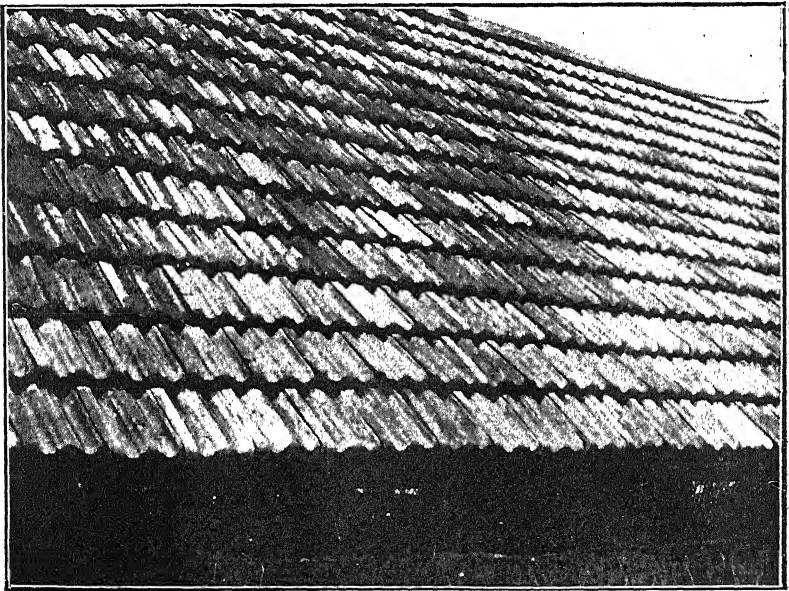


Fig. 5. Roof with Interlocking Tiles.

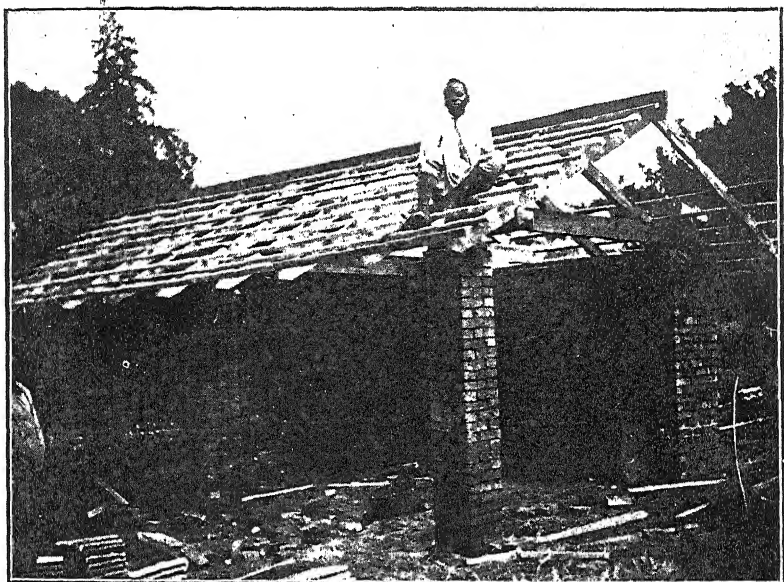


Fig. 6. Roof for Shingle Tiles.



Fig. 7. House at Mount Silinda showing Shingle Tiles laid 25 years ago and still giving complete satisfaction.

Burning.—Before burning the tiles it is necessary to prepare a kiln for the purpose. In the early days at Mount Silinda it was the practice to combine brick and tile-making and to burn both together. The kiln was built of the bricks in the ordinary manner until a point was reached two or three bricks above the eyes. From this point the bricks were used for building up the outside walls of the kiln, about two bricks in thickness, and in building inside partition walls midway between the eyes, thus leaving small rooms directly over the eyes in which the tiles were packed. This system is fairly satisfactory when tiles are to be made on a small scale, but if many are required it is far better to build a more permanent kiln of burned bricks, which can be used over and over again for the burning of the tiles. In the former method it is difficult to avoid either over-burning the tiles or under-burning the bricks, as the tiles, being thinner, require a shorter time for burning.

The tiles should not be placed in the kiln until thoroughly dry, and then they must be packed very carefully if warping is to be avoided during the burning. Many tiles which have reached this stage in first class condition may be rendered useless in the burning because of excessive warping if this care is not taken. The tiles should be packed as close together as possible, and made to stand absolutely upright on edge. There is considerable shrinkage in burning, so that in any event the tiles will be found to be loose and to lean somewhat after the burning has been completed. It should be the aim to keep this down to the minimum. In packing the kiln the tiles should be left face to face, as in the drying shed, and these pairs packed "head to tail," that is, alternating the direction so that the lugs on the backs will nest together and not interfere. They should be packed in small sections or blocks, first a section facing lengthwise of the kiln, and then a section facing crosswise. This is much better than packing in a solid row straight across the kiln, as it tends to minimise the effects of shrinkage during burning. The accompanying illustration (fig. 3) showing the method of packing interlocking tiles in the kiln serves equally well to illustrate the packing of the shingle tiles. The tiles may be packed six or seven rows deep, and should then be covered with one or two layers of bricks to prevent damage to the top row during burning.

The burning is the same as for bricks, except that a somewhat shorter time is required to complete the process. The same indications will be noted when the burning has been carried far enough. In the early stages the fires should not be allowed to become too hot, as too rapid heating of the thin tiles will cause them to warp and crack, but on the other hand it is important that they be thoroughly burned in order that they may be hard, as otherwise they will tend to soften and crumble during long rains when on the roof. If, on the other hand, they are considerably over-burned, they will shrink and warp unduly.

A gang of ten boys should turn out approximately five hundred tiles per day, but the losses between the time of moulding and the completion of the burning will amount to anywhere from 25 per cent. to 66 per cent. of this number. We have found that shingle tiles ready for

placing on the roof cost approximately £2 to £3 per 1,000. A thousand tiles will cover approximately 330 square feet of roof, which makes the cost per square (of 100 square feet) from 12s. to 18s. This compares very favourably indeed with corrugated iron, but it must be remembered that considerably more timber is required for the tile roof, though on the other hand a roof of good tiles will far outlast one of corrugated iron, being practically permanent. There is also the additional advantage of appearance and coolness in favour of the tiles.

Manufacture of Interlocking Tiles.—The manufacture of interlocking machine tiles is in some respects easier and simpler than the making of shingle tiles, but it requires a considerable amount of equipment, and could not be economically undertaken by the individual farmer, though it might be done by a group of farmers in the form of a small co-operative company.

This type of tile requires a press, especially made for the purpose and fitted with suitable dies, and there should be a "plunger machine" for making the rough clay forms from which the tiles are pressed. This latter is not an absolute requirement, as these forms might be moulded by hand. It is also necessary to have a large airy shed equipped with shelves and racks, in which to carry on operations and dry the tiles. The equipment in use at Mount Silinda, including machinery, shed and permanent kiln, is valued at approximately £200, which may be taken as a fair average of the necessary expense.

In this process the tile is removed from the press on to a specially made rack or palette which holds the tile flat during the early stages of drying and allows, at the same time, a free circulation of air on all sides of the tile. In other respects the process is practically similar to that already described. A gang of six or eight men will turn out in the neighbourhood of 300 tiles a day by this process. The approximate cost of these tiles ready for use, after allowing for breakage and for depreciation of equipment, is from £4 to £5 per 1,000. These tiles are larger than the shingle tile, and a thousand of them will cover slightly over 500 square feet of roof, making the cost per square (100 square feet) from 16s. to 20s. A roof covered with shingle tiles is illustrated in fig. 4, and one with interlocking tiles is shown in fig. 5.

Preparing Roofs for Tiles.—In preparing a roof for tiles it must be remembered that the tiles are much heavier than iron, and the roof must therefore be built of heavier timber. Shingle tiles make a heavier roof than do the interlocking type, because the shingle tile, which is approximately the same thickness as the other, must be overlapped so as to lie at least double on the roof, and preferably even more than this, while the interlocking tile overlaps but little. The weights of tiles will vary considerably with different clays. When made of the clay at Mount Silinda, shingle tiles weigh, when dry, approximately eleven pounds per square foot of roof, and interlocking tiles about eight pounds. When wet both will absorb quite a considerable amount of water, thus adding appreciably to the weight of the roof. Interlocking tiles will not absorb as much water as shingle tiles, as the

material is more dense and compact owing to the great pressure under which they are made.

At Mount Silinda it is our practice in roofing spans up to about 16 feet in the clear to use 2 in. x 4 in. rafters, spaced from 2 ft. to 2 ft. 6 in. on centre, with 2 in. x 6 in. or 2 in. x 8 in. tie-beams for each pair of rafters on the wider spans, and for each alternate pair of rafters on spans up to 12 feet. For spans above 12 feet there should also be a collar beam of $1\frac{1}{2}$ in. x 4 in. material, and on spans from 14 feet there should also be king posts or struts for each pair of rafters. On top of the rafters are nailed small purlins on which the tiles are laid. These purlins are usually made of 1 in. x 2 in. material for interlocking tiles, and are spaced 10 in. apart, which is the space covered by one row of tiles. In the case of the shingle tiles, if the best results are required, the purlins should be spaced only 6 in. apart, thus allowing for a covering area of 6 in. x 8 in. for each tile. These purlins are made considerably lighter, usually being 1 in. x 1 in. or 1 in. x $1\frac{1}{4}$ in. A construction of this type, which gives ample strength for carrying tiles, is shown in fig. 6.

Where it is desired to practise economy, and where good straight poles can be secured, it is quite possible to use pole construction for the entire roof with the exception of the purlins on which the tiles rest, which must always be of sawn timber. This will cut down the expense very materially in some cases. Where poles are used for rafters they should be slightly adzed on the upper side to straighten them and to give a suitable bearing for the purlins. This form of construction has been successfully used at Mount Silinda on a building about 15 ft. x 60 ft.

The pitch of the roof must be considerably greater for tiles than for iron. It is the practice of the mission to lay shingle tiles on a half pitch (45 degs.), but except for exceedingly heavy rainfalls or very large roofs it is not necessary to make so steep a roof. Interlocking tiles may be used on a flatter roof, even down to a quarter pitch in some instances, though there is then danger of slight dripping during very heavy rains.

The ridge in the case of gable roofs, and in the case of hip roofs both the ridge and hips, must be covered with either ridging iron or special tiles. Special ridge and hip tiles have been made and used with shingle tiles in some instances in the mission, but on some of these roofs, and on all of the roofs covered with interlocking tiles, ridge iron has been used for covering the ridge and hips, as this is cheaper than making the special tile required for that work, and the effect is not displeasing.

Laying Tiles on Roof.—Before attempting to place tiles on the roof they should be carefully sorted, and all that are warped or slightly cracked laid aside for use in the less important places, as over verandahs or eaves, or on unimportant outbuildings. In the case of machine-made interlocking tiles they should be carefully measured and sorted according to widths, as there is considerable variation in the

amount of shrinkage owing to slight variation in the quality of the clay when moulded, and in the amount and speed of burning. Tiles of different widths may be used on the same roof, but should be kept separated in the laying, as otherwise there will be a variation in the lengths of the different rows which will prevent the end-locks from fitting properly.

In laying tiles it is necessary to start at the bottom of the roof and work up, as each successive row overlaps the one below. Care must be exercised to break the joints, as in laying wooden shingles. If the tiles are laid in straight vertical rows on the roof, water falling on the vertical joints will follow the joint all the way to the bottom and there will be leakage. By breaking the joints any water seeping through between two tiles will be carried away by the tile underneath. The tiles are laid directly on the purlins, depending upon the lugs to hold them in place. No nails or screws are required.

Tile-making is by no means a simple matter, but on the other hand, it is not too difficult to be undertaken on the farm by any who have the inclination and are prepared to exercise the care and supervision necessary for good results. It is a pity that so little attention has been paid in the past to this important industry, and it will be an advance step for the country if the industry can be taken up and developed, both by individual farmers for their own needs, and on a larger scale near the towns, where there should be a ready sale for a well made product.

The Growing of Potatoes in Southern Rhodesia.

By C. MAINWARING, Agriculturist.

It is well to know something of the plant and its habit before studying its culture. The potato (*Solanum tuberosum*) is the most valuable of a very big family of plants. It is closely related to tobacco, tomato, and also to that troublesome weed, the wild Cape gooseberry. The potato is classed as an annual, but is virtually a perennial by means of its tubers. The flowers are borne in clusters, varying in colour from pure white to purple; the fruit or seed ball is a globular or short oval berry. It contains small white kidney-shaped seeds embedded in the midst of a green pulp. These seeds, if collected when ripe, can be sown for the purpose of raising new varieties. The tuber is an enlarged underground stem, and the eyes on it are equivalent to the leaf buds on the stems of a young fruit tree. Hence, when the seed (tubers) is expensive, or a variety is new, the tubers are cut to secure the largest possible increase in the shortest time. Although the crop is grown to a limited extent for domestic use by practically every farmer, the demand outside our own Territory is never very great, with the exception of a small increasing export to the Belgian Congo. Potatoes, therefore, are never likely to be grown on anything like so extensive a scale in Rhodesia as such crops as maize, tobacco or wheat. Efforts are being made by the Department of Agriculture to improve the yield and resistance to disease by testing new varieties and by seed selection. The following figures, showing the acreage and yield of the crop in Rhodesia during the seasons of 1920-21 and 1921-22, may be of interest:—

	Acreage under crop. (Summer grown.)	Total yield.
1920-21	1,519	36,220 bags (150 lbs.)
1921-22	2,827	36,811 bags

In this latter season the Salisbury district produced considerably over half the total crop from 1,164 acres, producing an average yield of over 22 bags per acre. The yield over the whole Territory for the 1921-22 season was very low, owing, no doubt, to unfavourable weather conditions, although individual yields of over 100 bags per acre were recorded.

Climate and Soil.—The potato, while requiring a liberal supply of moisture to ensure plants of vigorous growth and the formation of

an abundant and well shaped tuber crop, needs considerably less moisture as the time of harvesting the crop approaches. In fact, much rain at this time may result in considerable loss to the grower by injuring the flavour of the potato and greatly impairing its keeping or marketing quality. An unusually long continued spell of wet weather sometimes causes the entire crop to rot. Late rains following a drought, though not excessive, tend to create a renewal or second growth, which is very undesirable if the crop is intended for seed or market.

The soil considered best for potatoes is a deep rich friable loam, well stocked with humus. Wherever the land is naturally wet and heavy the quality of the tubers is sure to be unfavourably affected. Dry and wet seasons have a natural influence with soils, and in heavy lands after a hot dry summer the crop may be abundant and of good quality, while if the summer is a wet one, the plants succumb very readily to disease, and the tubers will be of a watery non-floury nature. If the soil is of a light sandy nature, the cost of manuring and fertilising will be greater, but this will probably be compensated by tubers of better quality and less expense in handling than is required for working heavier soils. Owing to blight and other potato diseases, a clean crop cannot be grown successfully on the same ground year after year, thus making rotation with other crops essential.

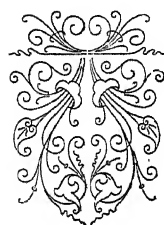
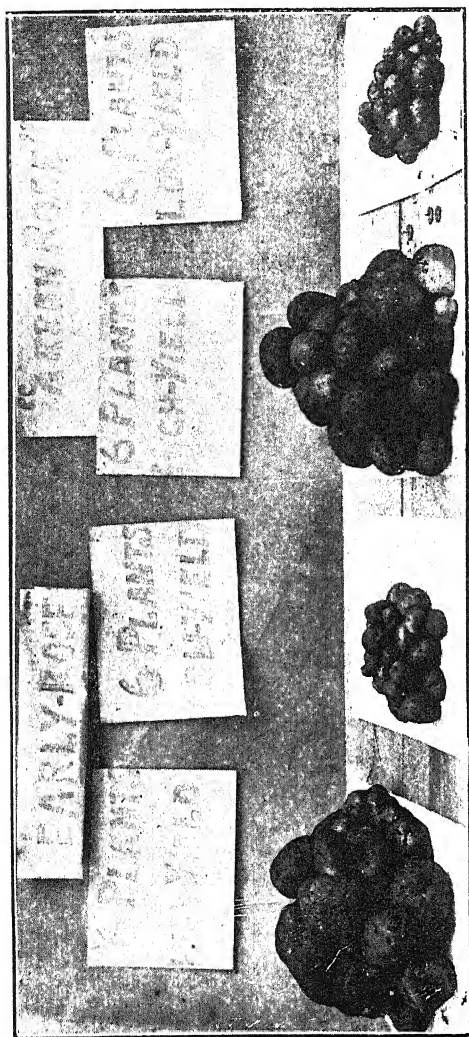
Cultivation.—The potato demands more cultivation than almost any farm crops. The depth of ploughing is an important factor, as the soil should be in rather a loose mellow condition. Cross-ploughing may be necessary if the land becomes set and hard before the seed is planted. If well-rotted manure is to be applied, it should be spread over the surface before ploughing; if light dusty kraal manure is used, it may be applied to the land just before planting and disced in. A drag harrow should follow the disc harrow to work down the soil properly. Sometimes one harrowing may do, but two are usually better.

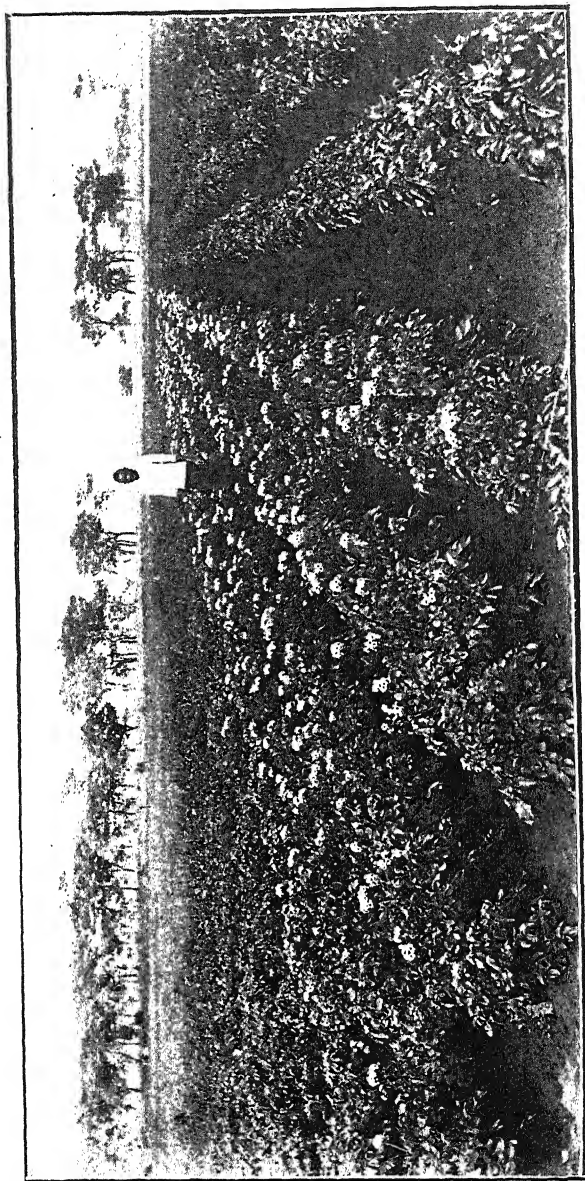
Varieties.—Experiments with the following potato varieties have been carried out at the Salisbury Experiment Station during the past two years:—

YIELDS OF VARIETIES.

Name of variety.	Yield. 1922.	Yield. 1923.	Average yield for two years.
Kerr's Pink	36½ bags p.a.	120 bags p.a.	75 bags p.a.
Majestic	53½ ..	100 ..	77 ..
King George	40½ ..	75 ..	58 ..
Great Scot	53½ ..	69½ ..	61 ..
Arran Comrade	46 ..	45½ ..	46 ..
Tinwald Perfection	43 ..	—	—
Lochar	37 ..	—	—
Bloomfield	30 ..	40 ..	35 ..
Early Rose	25½ ..	39 ..	32 ..
Dargill Early	27 ..	34½ ..	31 ..
Arran Rose	30 ..	13½ ..	22 ..

The severe drought of 1922 was responsible for the low yield of that season.





Potato varieties at the Experiment Station, Salisbury.

Selection and Preparation of the Seed.—Seed potatoes of a suitable size should be secured or saved from the previous crop. They should not be selected from diseased crops, for unsound tubers cannot produce healthy robust plants. Seed from a blighted crop, though apparently sound, may carry the disease, which is liable to be transmitted in turn to the produce of such seed. There is a considerable diversity of opinion as to the best size of seed to plant. Although it is scarcely possible to secure all seed of a uniform size, an effort should be made to avoid using either abnormally large or very small seed. Potatoes passed over a $1\frac{1}{2}$ inch sieve are a suitable size for planting. Large seed may be cut a day or two previous to planting, care being taken to leave two or three eyes in each portion. The cut surface should be dusted over with finely sifted lime or wood ash, which prevents, or at any rate retards, evaporation, and prevents the entry of fungus diseases.

Potatoes grown year after year in the same locality and from the same seed deteriorate in productiveness and in their capacity to resist disease. Imported seed gives the best results, but its high cost often prohibits a profit being made on the crop. Therefore, every endeavour should be made to supply home-grown seed to a greater extent than has hitherto been done. Clamping or pitting for the storage of table and seed potatoes has not proved a success in this country, and seed that is required for planting should be stored in a dry shed, and spread in layers of not more than 12 inches deep, protected from the sun, but exposed to the air. The free admission of air is important, and the greater the circulation the better. It has the effect of producing a slow and sturdy growth of sprouts which are much less liable to be knocked off at planting time than the long white sprouts produced in the dark. By sprouting the tubers and removing the sprouts their vitality is weakened, and a loss in yield is the result.

Planting.—The most suitable season for planting varies according to the climatic conditions of each district. The early potato crop grown with the aid of irrigation or on moist sandy vleis should be timed so that no frost may be expected after the plants are above the surface. If frost is expected when they are beginning to appear, cover them slightly over with soil. The main summer planting takes place from January onwards, and in this case the last date upon which they may safely be planted will depend upon the first frosts of winter. The amount of seed required to plant an acre will vary from 1,000 to 1,400 lbs., according to the size of the seed and the distance of planting.

There are two general methods adopted for planting: (1) is planting between ridges made by a "shovel or ridging plough," (2) is by planting behind an ordinary three-furrow plough. With the ridge system the tubers are planted at a more even depth, and consequently come up more evenly, and they are planted in straighter rows, and for these reasons they are more evenly cultivated. Also, in growing the crop under irrigation, this operation is greatly facilitated, as the water can quickly pass down the ridges and the land does not become waterlogged. Another point in favour of the ridge system is that it makes digging or ploughing out the crop a comparatively easy task. If level

culture is practised, some of the tubers are buried so deep that they are beyond the reach of the plough, or are bruised in the operation of lifting. Considering these points, the opinion is that the ridge system is the best one for crops planted under irrigation during August and September, and again for the January crops grown during our heaviest rainfall.

On the flat system a three-furrow plough is generally used, taking furrows about 12 in. wide, and the "sets" are placed by hand along the side of the last furrow turned up. This leaves room for the oxen to walk in the bed of the furrow without stepping on or disturbing the sets. If artificial manure is applied, it is convenient and desirable to sow it in the furrow in which the potatoes are planted. On a hot dry day it is advisable that the sets should be covered as soon as possible, as they get quickly scalded by the sun, and a poor stand or weak growth is the result. After the field is planted, ordinary methods are employed as with other crops; the land should be harrowed at intervals until the plants are above the ground. This is the cheapest and most efficient method of keeping the weeds in check and the soil in good condition. A light drag harrow of any type is satisfactory. As soon as the potatoes can be seen along the rows the cultivator should be used to stir up the soil. Hand-hoeing will be necessary at least once or perhaps twice to destroy the weeds around the plants. When the plants are 6 to 8 inches high, they should be "earthed" up with the ridge or shovel plough; as much earth as possible should be raised without covering the plants.

Lifting the Crop.—Good prices are usually obtained for early potatoes, and they may be dug as soon as they are large enough. The crop grown for winter and spring markets is best left in the ground in which it is grown and lifted as required. There are two general methods adopted in Rhodesia for lifting the crop: (1) natives digging with forks or grubbing with hoes, (2) the potato or shovel plough. When the plough is used, the land will require to be harrowed several times, to expose any tubers not previously gathered and to level the land. Very large losses result from faulty practices at the time of lifting the crop. Through carelessness, lack of labour or other causes, many growers allow their potatoes to be exposed to the hot sun after they are dug up, and potato scald develops. Although the damage may not be evident at the time of bagging, the injured potatoes usually develop soft rot, and become rotten and worthless during transport to market, or soon after their arrival at their destination. Potatoes should not be dug more rapidly than they can be picked and placed in the shade. Whether the potatoes are dug with hoes or ploughs, care should be taken to reduce the number of cuts and bruises. These offer an entrance for disease, besides damaging the appearance and causing waste.

Grading.—Even a well-grown crop of potatoes may lose a large part of its market value if not properly graded. Ungraded potatoes cannot compete with a graded sample on the market except at a loss. The local merchant who buys such potatoes either has to sell them at a lower price or he must grade them himself. In either case he pays the farmer less. Appearance is a big factor in the sale of table potatoes.

Grading is necessary in order to give the consuming public what it demands. The marketing of the crop raised during January and February requires much care and attention. The potatoes should be forwarded to their destination as soon as possible. If they are bagged and stored even for a few days, they will begin to "heat," and decay soon follows. The riper and drier the tubers are dug, the better are their keeping qualities.

Rotation for Potatoes.—An excellent rotation for the potato grower is a three-year cycle of potatoes, maize and velvet beans. The crop should be so arranged that a piece of velvet bean land is always available for potatoes. This will do more to help to produce good yields than any other one thing, except the use of manure. Velvet beans greatly improve the condition of the soil for potatoes, add fertility, and if ploughed under in the autumn, and the land is thoroughly worked again in the spring, leave it in the best of condition. One of the principal benefits to be derived from the above rotation is the control over insect and parasitic enemies: potato rot, scab and other fungus diseases live in the soil as well as on the tubers, and time must be given between the potato crops to allow them to die out.

Diseases and Pests.—Scab is a common disease, and is found almost everywhere that potatoes are grown. The chief source of infection is scabby seed. Heavy dressings of kraal manure favour the development of scab, and should not be applied fresh to the crop. Potato blight attacks the leaves of the plants, and appears in the form of brownish spots. The tubers are not affected, but if the disease attacks the crop during its growing period, much of the leaf surface is destroyed, and the yield is very greatly reduced. The Chief Entomologist recommends spraying an infected crop with Bordeaux mixture. The most serious pest which destroys potatoes in this country is the potato tuber moth, and judging from reports received it is on the increase. The moth is grey-brown in colour, about half an inch across the wings, and may, if disturbed, be seen making short flights in the potato field. It burrows its way into the cracks in the soil, and lays its eggs generally in the eye of the potato. The eggs soon hatch out into small caterpillars, which burrow into and destroy the tubers. Generally only those tubers nearest the surface are destroyed. As a prevention, it is recommended that the potatoes in the ridges should be earthed up with as much soil as possible, in order to prevent as far as possible the moth gaining access to the tubers. It is advisable not to plant infected seed on land that is free of the pest.

White v. Yellow Maize.

By G. N. BLACKSHAW, O.B.E., B.Sc., F.I.C., Chief Chemist,
Department of Agriculture.

There has been a considerable amount of discussion in this and other countries concerning the relative merits of white and yellow maize both from the grower's and feeder's points of view, and the fact that Argentine La Plata maize has of late years almost invariably commanded a higher price on the European market has led some of our farmers to doubt the advisability of Southern Rhodesia specialising solely in the production of white flat maize.

For some time the Rhodesian Government Agriculturists have consistently recommended that growers in the maize exporting areas of this Territory should confine their attention to the production of white dent varieties, and in dealing with the question generally, with the feeding values of flint and dent maize, and with the use of maize in manufacturing processes, it will be the endeavour of the writer to bring evidence to bear upon the wisdom of that advice.

The small flint maize of the Argentine undoubtedly possesses an advantage over white flats, yellow dents and the larger flint varieties for the feeding of poultry and pigeon types of live stock, but that is largely on account of the size and shape of the berry. Before comparing the varieties of white and yellow maize, however, from the standpoint of relative feeding values, the attention of the reader is drawn to an advancement of outstanding importance that has been made in the scientific study of feeding during recent years, namely, the discovery of the part played by certain substances, called vitamins, in the nutrition of human beings and live stock generally; which subject is dealt with in a special article in this *Journal*.

A point of difference between white and yellow maize, of which much is made in some quarters, is the deduction made from certain feeding experiments with rats and swine that yellow maize is characterised by the presence of some vitamin A—also called "fat-soluble vitamin"—whilst white maize possesses no demonstrable amount of that particular vitamin.

On the other hand, in an abstract of a recent report of the Rowett Institute, Aberdeen, which appeared in the *Fertiliser and Feeding Stuffs Journal* of 17th January, 1923, the following reference is made to recent research work in the study of vitamins which has been conducted at that institution. In one experiment, the food for pigs was



Typical sand veld on which maize has been grown for a good many years.
Crop planted mid-November, kraal manure and a little wood ash applied.
Rainfall about 20 inches at time photograph was taken. Mr. H. N.
Gaskell's farm, Sunnyside, Marula.



boiled with the object of destroying the fat-soluble vitamin (vitamin A) and the anti-scorbutic vitamin (vitamin C), and groups of pigs were fed on the boiled food, some groups having the vitamins added artificially. At the end of sixty-four days the animals in all groups were in perfect condition, and it was decided that the boiling of the food had not interfered with the health of the animals, nor had the addition of vitamins been accompanied by any marked beneficial effects. Another experiment, in which a group of pigs was fed on a ration from which the anti-scorbutic vitamin was absent, indicated that in the ordinary course of events pigs were quite unlikely to suffer from any deficiency of this constituent. In many of the experiments on diets deficient in mineral matter the condition of the animals resembled that associated with vitamin deficiency, and it was found that these could be cured by the addition of the minerals which were absent. It is, therefore, considered that in some of the work on vitamins beneficial results have been ascribed to them which were partly, or wholly, due to mineral matter.

From the foregoing particulars, it is clear that much more work will have to be carried out upon the subject of vitamins before complete agreement is arrived at between research workers in this important line of investigation. Deductions may be drawn by some workers concerning the presence or absence of vitamins in certain feeding stuffs, and, furthermore, beneficial results may be attributed to vitamins which—as the report of the Rowett Institute indicates—may or may not be substantiated by subsequent investigation.

Vitamins have, so far, never been isolated from the materials in which they occur, consequently their presence in or absence from any material cannot be proved definitely by chemical analysis. Empirical tests by means of feeding trials must therefore be conducted, and this line of investigation to determine the presence or absence of a vitamin in the case of any particular variety of a foodstuff is beset with many difficulties, and much very careful work, repeatedly corroborated under varying conditions, must be carried out.

Mr. John Golding, Research Chemist, University College, Reading, in a communication recently received from him by the writer, stated that “a good deal of work has been done on the vitamin A content of white and yellow foodstuffs. Dr. Drummond and Miss Coward have done a considerable amount of work in this direction. Although the yellow pigment is apparently not the vitamin A, yet at the same time there seems to be some connection or association between the two.” Those workers who find that there is a difference in the vitamin A content of yellow and white seeded varieties of the same species of plant will probably accept the view that the yellow seeds are not rich in vitamin A, and, that being so, the amount of evidence so far adduced in favour of yellow seeded varieties as regards vitamin A content is not overwhelmingly conclusive when one considers the number of factors which can influence the results of feeding tests.

Whatever the truth may be, in feeding practice it would appear that the quantity of vitamin A in yellow maize is not sufficient to

ensure that yellow maize, fed at normal rates, will supply the animal with this vitamin in sufficient amount; consequently steps should be taken, whether the maize used be white or yellow, to include in the animal's ration some other ingredients which assuredly will provide the requisite supply.

If animals are supplied with material rich in vitamin A, such as succulent green stuff, the relative nutritive values of white and yellow maize are on exactly the same footing, and are solely dependent upon the relative amounts of the digestible nutrients—protein, carbohydrates and oil—which they contain. Regarding the nutrients and relative feeding values of white and yellow maize, Henry and Morrison, in their handbook on the feeding of farm animals,* state as follows:—

"Being so rich in carbohydrates, maize is naturally low in crude protein. The crude protein of this grain is also somewhat unbalanced, for about 58 per cent. of it consists of the single protein zein, which lacks some of the amino-acids necessary for animal growth. Maize is also unusually low in mineral matter, especially calcium, so necessary for growing animals. Numerous experiments show that even with fattening animals, which require relatively little protein and mineral matter, it is profitable to supplement these deficiencies of the maize grain by other feeds high in the nutrients which maize lacks. Fortunately the legume hays are rich in protein and calcium, and therefore admirably supplement maize. By the use of these roughages, less protein-rich concentrates are needed to balance a heavy allowance of maize. Indeed, for some animals legume hay and maize alone form a satisfactory, well-balanced ration.

"Three races of maize—dent, flint and sweet—are of interest to the stockman. In dent maize, the starch is partly hornlike and partly floury, rendering the kernel easy of mastication. In flint corn, the starch is mostly hornlike and flinty, making the kernel more difficult for the animal to crush. Both chemical analyses and *experience* oppose the assertion often heard that yellow maize is more nutritious than white, or the opposite. In fact, the colouring matter of yellow maize is so minute in quantity as to be unweighable. While a certain strain or variety of one may be superior to any particular strain or variety of the other in a given locality, there is no uniform difference between white and yellow maize in productiveness or feeding properties."

In making the above statement, Henry and Morrison doubtless did not concern themselves with vitamins, which have come into prominence since the last edition of their work was published (1915), but rather with the nutrients contained in varieties of maize and their relative feeding values based on long practical experience.

Until the conditions of farming in this Territory have advanced to the stage when maize is consumed in large quantities on the farm for the feeding of stock, there will always be a considerable surplus of grain for export in normal years. In that connection, Mr. Canham, the Union Trade Commissioner in London, in a very interesting ex-

* "Feeds and Feeding," by Henry and Morrison, 15th edition.

pression of his views on export matters, which appeared in the *Farmers' Weekly* of 17th January, 1923, quoted the following opinion of firms connected with the South African export maize trade:

"I am of opinion that the growth of No. 4 maize³ should be entirely discouraged, as there is no market for it."

"It is true that in pre-war days, when there was only a small quantity of South African white flat maize coming, it did frequently command a higher price than Argentine maize, but that was mainly owing to its comparative scarcity and the fact that it is used for an entirely different purpose."

"The reason why South African maize, by which I presume you mean No. 2 white flat, is now quoted below the price of Argentine is because No. 2 white is only fit for manufacturing purposes, consequently the demand for it in this country is very restricted, whereas the demand for the Argentine maize, which is used for feeding purposes, is very large, and the No. 6 grade of South African maize† is the only quality that competes with it at about one shilling per quarter less money."

Three questions in particular are raised in the opinions quoted above, viz., the suitability of white flat maize for feeding purposes, the use of maize for manufacturing purposes, and export prices.

Concerning the statement that No. 2 white is only fit for manufacturing purposes, everyone acquainted with practical farming knows that such a report is entirely wrong, and the statements of Henry and Morrison—recognised authorities on the feeding of farm stock—are sufficient to point out its inaccuracy.

There is not the least doubt that the white flat maize grown in this country is the best maize procurable for manufacturing purposes, and, owing to its excellence in that respect, it frequently realised the highest prices quoted on the export maize market in pre-war days. Maize is largely used for the manufacture of alcohol and starch, and is used to a less extent in other industries, such as the manufacture of synthetic rubber. In the United States and Denmark large quantities of spirits are made from maize, and the same is the case in Hungary in normal times. To some extent alcohol is also manufactured from maize in Germany. Prior to the war Germany was the largest starch manufacturing country, about 8 per cent. of the total output of starch from that country being procured from maize. More than three-quarters of the starch output of the United States, where maize starch manufacture is an enormous industry, is made from maize. These particulars are given to indicate the demand for white flat maize for manufacturing purposes and countries which furnish big buyers of maize for use in manufacturing processes.

The Continent being the most important market for South African maize for such use, it follows that one of the principal markets is

largely curtailed for the time being, and will continue to be so until economic conditions have become stabilised. That market will assuredly return in time, however, and is one in which the small round berried maize of the Argentine can never compete with white flats on terms of equality.

Turning to export prices for maize, we find that the average prices quoted on the London market for La Plata, No. 6 South African (*i.e.*, yellow round) and No. 2 white flat for the first eight months of 1922 were as follows:—

	La Plata.	No. 6 South African.	No. 2 white flat.
Per quarter (480 lbs.)	36/-	34/4½	32/10½
Equivalent to per bag (200lbs. grain)	15/-	14/4	13/8½

During that period we note that on the average La Plata and No. 6 South African realised per bag 1/3½ and 7½d. respectively more than No. 2 white flat. Assuming that an increased demand for No. 2 white flat for manufacturing purposes or a better appreciation by the British farmer of the feeding qualities of white flats compared with yellow flints does not arise to cause the price of No. 2 white flat to soar, and that the relative prices of the three types remain as given above, it would appear to the inexperienced critic that it would pay best to grow yellow flints. Comparative yields per acre of flints and dents must, however, receive consideration before any decision on that question is justified.

The Rhodesian Government Agriculturists have frequently pointed out that good flint maize will not yield as heavy a crop of grain as good dent maize where soil and climatic conditions are favourable for the latter, as is the case in the maize exporting areas of Rhodesia. Mr. Walter Pepworth, of Natal, and Mr. J. Read, Balfour, Transvaal, in the *Farmers' Weekly* of 14th February last, also drew attention to the same fact, Mr. Pepworth remarking that a crop of the old type of Congo (a flint variety), whilst an excellent mealie for the high veld where early frosts are expected, would only give a yield of four or five bags per acre, whereas improved dent varieties will give a return of ten or twelve bags per acre. Thus, in the opinion of experienced men, the higher yields from dent maize compared with those obtained from flint varieties more than compensate the grower for the slightly higher prices that may be offered for small flint maize on the export market.

Vitamins.

By A. W. FAGER, B.A., A.I.C., Chemist, Department of Agriculture.

In past times sailors were particularly liable to contract scurvy, a severe constitutional disease involving general debility and very often causing death. The cause of this scourge was a mystery, and although it was suspected that diet had much to do with it, as late as 1911 prominent scientists disagreed as to whether it was due to harmful substances present in salt meat, or to the absence of some vital factor from the diet. It was known that fresh fruits and vegetables not only acted as preventatives, but frequently effected remarkable recoveries from advanced stages of the disease. As far back as 1795 lime juice was regularly administered in the British Navy, and by that simple precaution scurvy was virtually extinguished in the service, although it persisted in the mercantile marine until 1865, when it was practically eliminated by the same method. As lime juice was not found to be rich in the recognised nutrients (proteins, etc.), its "anti-scorbutic" efficacy was not understood.

There was another mysterious disease called beri-beri, which was confined to the East, and to countries where rice was the chief article of diet. It occasioned severe nervous disturbance, very often with fatal results. Its ravages in the Japanese Navy prior to 1884 induced the Japs to try a change in naval ration, with the result that beri-beri disappeared.

Some scientists considered that it was due to fungoid growths on poor quality rice, but this view was disproved by the discovery that people who lived on rice which had been cleaned and polished by the removal of the germs and bran were very much more liable to get beri-beri. It was found that pigeons which were fed solely on polished rice soon developed symptoms resembling those of beri-beri, which, however, disappeared when rice millings were included in the diet. A chemist named Funk then worked upon the rice millings to try and isolate their "anti-beri-beri" constituent, and, under the impression that he had succeeded, and had got a definite chemical compound which was similar in composition to the ordinary amines of organic chemistry, and yet a very potent and indispensable factor in maintaining life (Lat. : *vita*), named it "vitamine."

Subsequent work proved that, although Funk was mistaken in his belief that he had isolated one of them, he was right in his contention that there are certain obscure substances whose presence is indispensable

to health, and whose absence is the cause of certain diseases which are known as the "deficiency" diseases. These substances are now grouped together for convenience of reference under the term "vitamins," but it should be remembered that the name is purely an empirical one, and should not be regarded as defining or suggesting similarity of composition or properties.

How Vitamins are Investigated.—The food components known as nutrients (protein, fat, carbohydrates, etc.), upon which the value of a feeding stuff is usually assessed, can be accurately determined by chemical analysis, but so far no such method has been devised for the vitamins, none of which has yet been isolated, and which have to be investigated by lengthy and oft-repeated feeding experiments upon animals. A typical experiment is as follows:—A number of rats, pigeons, chickens or pigs, etc., are fed upon a diet from which the particular vitamin to be investigated is absent, until (after some weeks or perhaps months) they exhibit pronounced symptoms of the deficiency disease corresponding to the vitamin. The food under examination is then administered regularly, and its effect upon the condition (health, weight, etc.) of the animals carefully noted. The results of such experiments are open to several objections. They are merely qualitative and comparative, indicating whether a certain foodstuff contains much, little or none of the vitamin, but do not give even an approximate idea of the percentage amount present. Further, they are, of course, dependent upon the individual co-efficients of the animals employed, and as such co-efficients may vary considerably in members of the same species, and very considerably with different kinds of animals, a large number of such experiments must be performed before a decision upon the vitamin content of any particular foodstuff can be arrived at. Bearing this in mind, and also that the study of vitamins is only about twelve years old, of which nine were abnormal, one is more inclined to be surprised at the number of results obtained, than at their approximate, and sometimes indefinite, character.

Classification of Vitamins.—There is definite indication that there are at least three different types of vitamins with characteristically different functions. They are named Vitamin A, Vitamin B and Vitamin C, and their chief characteristics are as follows:—

Vitamin A. Soluble in Fat.—This substance is supposed to be specially important for bone development and growth. Without it animals are particularly liable to suffer from eye disease and rickets.

Vitamin B. Soluble in Water.—This substance is important for growth. Without it human beings contract beri-beri, and birds and rats become paralysed.

Vitamin C. Soluble in Water.—Without this human beings develop scurvy (see above).

Distribution of Vitamins.—It appears to be definitely established that plants are the only organisms which have the power of building up vitamins for themselves. Hence the herbivora must take in their vitamin requirements as such from plants, and pass them on as such

to the carnivora. The distribution of the vitamins in the more common foodstuffs is presented in the following table:—*

	Vitamin A.	Vitamin B.	Vitamin C.
Best and most usual sources.	Fish liver oils. Green plants, including clover, lucerne and hay. Butter, milk and cheese. Egg yolk. Animal fats. Some roots, such as carrot, parsnip, mangold.	Seeds and grains, particularly in the germ and outside layers of cereals. Yeast. Egg yolk. Milk. Green plants, including clover, lucerne, hay. Many roots and tubers—e.g., carrot, potato, turnip, mangold, beet.	Green vegetables, especially of the cabbage tribe. Orange and lemon juice. Swedes and turnips. Germinated seeds. Tomatoes. Milk. Potatoes.
Present in smaller amounts.	Oil seeds. Oleo-margarine in proportion to animal fats. Cereals.	Meat. Some fruit juices. Cheese.	Meat. Many roots and tubers. Many fruit juices. Dried vegetables.
Absent from	White flour and bread. Most vegetable oils. Most lard. Most margarine. Yeast.	White flour. Polished rice. Fats.	Seeds and grains. White flour and bread. Fats. Yeast.

Priority in the above table indicates a greater proportion of vitamin. As one would expect, green grasses and vegetables, which are the sole food of the herbivora, and milk, which is the sole food of the young, are well supplied with all the vitamins. A considerable proportion of the "A" in milk is removed with the cream, but skimmed milk still contains a certain amount of this factor as well as considerable amounts of "B" and "C." Seeds and grains are very well supplied with "B," and cabbages and citrus fruits are very rich in "C." Fish concentrate large stores of "A" in their liver oils; particularly is this the case with cod-liver oil, which is said to contain about 200 times as much "A" as fresh butter (itself a valuable source of "A").

The process of refining food tends to remove the vitamins, so that white flour contains none, and polished rice contains none of its original "B."

* Taken from the *Fertiliser and Feeding Stuffs Journal*, vol. vii., No. 2, 19th July, 1922.

The process of germination considerably increases the amounts of "B" and "C" in grains. The common plant oils (e.g., coconut, linseed and cotton seed oils) contain no vitamins. Young growing plants are richer in vitamins than old grown ones.

Some General Properties of Vitamins.—There is some speculation and even disagreement about these, but the following are the more prominent ones, concerning which there appears to be fairly general agreement. Storing and heating are inimical to vitamins, especially in the presence of air. This is particularly the case with "C." As very small quantities of them are able to produce such marked effects, it is improbable that they act as sources of energy or body-building material after the manner of the nutrients; they are conceived to function as the catalysts, or unconsumed activating principles of certain processes essential to life. They are quite different from the nutrients, which they cannot replace any more than they can be replaced by the nutrients. They are all indispensable to life and health. Each of them performs a specific function, so that the evil effects of the absence of one cannot be avoided by excess of another, and a proper ration must contain an adequate supply of all three.

Practical Applications of the Above. 1. *In the Home.*—Human beings, and especially growing children, should have a varied diet, the different components of which should contain liberal supplies of all the vitamins. Milk, butter, cream, eggs, vegetables (especially fresh vegetables) and fruits (especially citrus) are all valuable in this respect. Weakly people, and particularly children, frequently derive great benefit from moderate doses of cod-liver oil, very probably on account of stimulation by Vitamin A. Milk should not be boiled nor vegetables cooked any longer than necessary, as vitamins are diminished by heat. There is no reason to boycott canned or preserved foods, some of which are highly nutritious, but vitaminic substances should be included in the diet.

2. *On the Farm.*—Cattle which are grazing on green grass are undoubtedly able to get sufficient vitamins, but it is conceivable that they may suffer from temporary vitamin deficiency if they only obtain bleached grass, as is sometimes the case towards the end of the dry season. Lucerne, lucerne hay, veld hay, ensilage, carrots, mangolds, turnips, beet, pumpkins, potatoes and mealies all contain one or more vitamins; bleached hay from mature plants being less valuable in this respect than well-cured hay from younger plants. In the rationing of stall-fed cattle due regard should be given to vitamin requirements. Particular attention should be given to this aspect in feeding dairy cattle, as, unless sufficient vitamins are given in the food, the animal attempts to maintain a certain, if sub-normal, vitamin content in the milk by drawing upon the reserves in her own tissues, thereby seriously menacing her own health. If calves are not allowed sufficient milk there is danger that vitamin deficiency may become a limiting factor, and they may lack vigour, be tardy in growth, or develop "white eye."

Vitamin foods should not be overlooked in pig feeding, especially when the animals are shut up. Reference to the above list and to

the foregoing table will suggest suitable components for rationing. In poultry feeding it should be remembered that eggs are rich in vitamins (particularly in "A"), which should be supplied in the ration. Fresh green stuff (especially cabbage and lettuce) is commendable for this purpose, as are also sprouted grains.

The above does not purport to be a complete scientific discussion of the subject, but is intended as a plain statement of the broader issues of the vitamin theory. It records no work nor ideas original to the writer, but is a *resumé* of information culled from so many sources that individual acknowledgment would be tedious.

In conclusion, it should be remembered that the vitamin idea is new, and like all new theories has its enthusiastic devotees who would stretch it too far, and its critics who doubt its fundamentals. The method of investigation is tedious, and similar experiments sometimes give very different results with different workers. Hence progress must be slow if it is to be sure. The wisest plan would seem to be to give vitamins a place, but to keep them in their place. A good ration often is a mixed one; the vitamins must be included, but so must the nutrients, which alone are capable of supplying energy and building up flesh. It is therefore unreasonable either to condemn a concentrate, rich in nutrients, because of its lack of a particular vitamin, or to bolster up a feeding stuff, known to be deficient in nutrients, on account of a supposed richness in vitamins.

The Show Season.

The following are the dates of the agricultural shows so far as we have been able to ascertain them:

Umtali, 29th and 30th June.

Sinoia, 9th, 10th and 11th July.

Bulawayo, 31st July, 1st and 2nd August.

Salisbury, 14th, 15th and 16th August.

It will be noticed that the Bulawayo show is to be held much later this year. It will thus be possible for exhibitors from the Union to send their animals on to the Salisbury show. The later date will also render it possible for farmers to exhibit the season's produce at Bulawayo and it is to be hoped that the farmers of Matabeleland will support the Society in this respect.

Legumes in Southern Rhodesia.

By J. A. T. WALTERS, B.A., Agriculturist.

Leguminous plants occupy a unique place in the economy of the farm. Not only do they supply one of the principal constituents of human and stock food in abundance, but they also return to the soil on which they are grown a bountiful supply of its most valuable plant food. Upon their liberal employment in any system of farming depends very largely the continuance of the fertility of the lands, and the well-being of the stock. In Rhodesia leguminous plants are abundant, more particularly in the form of trees such as the numerous Acacias, M'sasa (*Brachystegia randii*), M'nondo (*Berlinia paniculata*), M'futi (*Brachystegia goetzii*), Mopane (*Copaifera mopane*), etc., etc. The veld on the whole is not naturally well provided with leguminous herbs, although the total number of species is great, and it is only rarely, as in the case of the so-called "vaal bosch" (*Eriosema insignis*), that any particular species occurs plentifully. It is further a notable fact that those legumes which do occur are not much utilised by cattle as food. Thus this same "vaal bosch" which is so abundant around Salisbury and on the prevailing red soils is never eaten in the green stage, although it is reported to make palatable hay. The Rhodesian farmer then is at a disadvantage in this respect when compared with the European farmer, who finds plentiful supplies of native clovers and other edible legumes in his pasture. He is faced with the problem of making good this deficiency, the most obvious solution of which would seem to be the introduction of exotic legumes of proved worth. Experience with exotic grasses has shown that many of the best European and American species were not adaptable to Rhodesian conditions. Fortunately, however, with a few important exceptions, most of the best legumes of other countries have proved suitable and well adapted to our climatic conditions, and their introduction has met with very striking success.

Legumes as Foodstuffs.—Legumes are usually rich in the element of food known as *protein* in every part of the plant. Hence, whether grown for grain or converted into hay, they have a similar value as constituents of foodstuffs. Frequently the *seed* is of primary importance, as in the case of ground nuts, haricot beans, velvet beans, cow-peas, tepary beans, dhal, peas and soya beans. In some cases, however, the seed is either too insignificant as a food, as in the case of lucerne or beggar weed, or too indigestible, as in the case of Jack beans. Sometimes the *whole pod* has a peculiar value for feeding purposes on

account of the sugary substances contained in it. Such are the locust or Carob bean, and the Algaroba bean, natives of the Mediterranean countries and of Western America respectively. Several of our native trees produce edible pods which are greatly appreciated both by game and by native cattle. Many of our acacias produce such pods. The big flat pod of *Bauhinia fassoglensis* is well liked by stock, as also is the long round pod of *Swartzia madagascarensis*. Other legumes again are valuable principally for the *stalk* and *leafy* portions of the plant, which provide palatable fodder, such as lucerne, clover, vetch, beggar weed, kudzu vine and others. The most valuable part of these plants is the leaf, the stem being frequently fibrous and even woody, and it is of great importance in the conversion of these plants into hay to avoid undue loss of this leafy portion.

The fact that the Rhodesian veld is lacking in edible legumes may, in spite of the excellence and plenty of the grass, lead to a condition known as "protein or albumen starvation." This is particularly the case with imported and improved cattle. Native stock and game, on the other hand, seem to realise the value of the pods and leaves of the leguminous trees referred to above, and it is possible that the constant good condition of such animals may be due to this fact. Among the few native herbaceous legumes that are grazed by stock generally may be mentioned the Rhodesian lucerne (*Albyssicarpus* spp.); a few of the many wild indigos (*Indigofera* spp.); the sweet-pea-like plant "Gumba-gumba" (*Dolichos lupiniflorus*); and the Rhodesian kudzu vine, an undetermined species resembling the imported variety. There is reason to believe, however, that many others are readily eaten when converted into hay.

Analyses of the food provided by plants in the form of fodder or grain show the amount of the three constituents—*carbohydrates* (starch and sugar), *proteins* and *fat*—they contain. Tropical countries are usually regarded as the great starch producers, and it is undoubtedly true that plants rich in starch, such as maize, cassava, sweet potatoes, bananas, etc. etc., thrive in such countries. On the other hand certain families of plants, such as legumes, are distinctively rich in protein or albumen. It is of great importance that the stock feeder, if he is to feed profitably and economically, should so manipulate his foods that they contain suitable amounts of each element for the well-being of the animal. The following table in which maize as a starch food is contrasted with leguminous foods in respect of these constituents will illustrate the relative values of some of the principal Rhodesian fodders:—

	Protein.	Carbo- hydrates.	Fat.	Albumi- noid ratio.
Maize (mealies) ...	10.5 per cent.	69.5 per cent.	5.4 per cent.	1:8
Velvet beans	23.0 ..	48.0 ..	6.5 ..	1:2.8
Ground nuts	28.0 ..	15.5 ..	39.5 ..	1:4.1
Haricot beans	21.5 ..	47.5 ..	1.2 ..	1:2.3
Soya beans	36.3 ..	27.5 ..	18.0 ..	1:2
Peas	23.5 ..	50.2 ..	0.8 ..	1:2.2
Maize fodder	4.5 ..	34.7 ..	1.5 ..	1:8.5
Lucerne hay	14.3 ..	42.7 ..	2.2 ..	1:3.4
Ground nut hay	10.7 ..	42.7 ..	4.6 ..	1:4.6
Velvet bean hay	14.0 ..	30.6 ..	1.8 ..	1:2.5
Beggar weed hay	12.0 ..	42.0 ..	2.9 ..	1:4.1
Cowpea hay	16.5 ..	42.2 ..	2.9 ..	1:3

From the above table it will be seen what a *narrow* ratio is provided by leguminous foodstuffs indicating a comparatively high protein content. Maize food, on the other hand, has a *wide* ratio, indicating richness in carbohydrates or starch. The careful stock-feeder is he who obtains the correct proportion of both classes to attain the end he has in view in feeding.

Legumes as Soil Renovators.—As a consequence of being rich in nitrogen in every part of the plant, legumes are particularly valuable as supplies of plant food when incorporated with the soil by ploughing. For this purpose the whole plant may be ploughed under, or the tops may be removed for hay or fodder and the stubble and roots only ploughed under. Investigations made by the Chief Chemist and reported upon in the issue of the *Rhodesia Agricultural Journal* for October, 1921, gave the following figures for the green weights and fertilising ingredients per acre of leguminous crops turned under at the Agricultural Experiment Station, Salisbury:—

	Green weight.	Dry matter.	Phosphoric		
			Nitrogen.	oxide.	Potash.
Sunn hemp ...	19,344 lbs.	9,119 lbs.	210 lbs.	23 lbs.	115 lbs.
Kaffir bean ...	13,680 lbs.	3,962 lbs.	150 lbs.	25 lbs.	161 lbs.
Velvet bean ...	13,416 lbs.	6,390 lbs.	191 lbs.	30 lbs.	108 lbs.

But the total contribution of nitrogen does not stop here. The nodules so freely formed on the roots of certain legumes are extremely rich in nitrogen, obtained, not from the soil, but from the air, and fixed in these nodules by micro-organisms or bacteria. The amount of nitrogen deposited in the soil by these nodules has been estimated to average about 120 lbs. per acre, or an equivalent of 800 lbs. of nitrate of soda. This is well borne out by the beneficial effect of a leguminous crop upon the succeeding crop, benefits now realised and recognised by Rhodesian farmers and embodied by them in their farming practice.

The crop most favoured for this purpose in Rhodesia is the velvet bean. This legume has consistently resulted in a very marked improve-

ment on the succeeding maize crop, and to a lesser degree the improvement has lasted for several seasons. Its use in a definite manner in rotations has resulted in helping to maintain the fertility of the soil and the high yield of grain. Other legumes, such as Sunn hemp, have given almost equally gratifying results. The following tables, showing the yields of maize obtained after a series of leguminous and non-leguminous crops, show the advantage resulting from the use of the former:

1919-20.

Maize after velvet beans	18.0	bags per acre.
Maize after cowpeas	12.9	..
<i>Average yield after legumes</i> ...	15.4	..
Maize after maize	9.9	..
Maize after oats	12.5	..
<i>Average yield after non-legumes</i> ...	11.2	..

1920-21.

Maize after Sunn hemp	11.3	..
Maize after velvet beans	10.2	..
Maize after ground nuts	9.2	..
<i>Average yield after legumes</i> ...	10.2	..
Maize after Niger oil	9.5	..
Maize after oats	8.75	..
Maize after hibiscus	8.5	..
Maize after cotton	8.5	..
Maize after linseed	8.25	..
<i>Average yield after non-legumes</i> ...	8.7	..

The ease with which the recognised valuable imported legumes can be grown has made investigation with native legumes almost superfluous. Several of our native plants are, however, now being tried for the purpose of green manuring at the Agricultural Experiment Station, Salisbury, the principal being species of *Crotalaria* and *Sesbania*, both producing heavy yields of nodules on the roots. Results of their effects upon the succeeding crops are not yet available.

Legumes for other Purposes. Apart from their usefulness as fodders or for green manuring, certain legumes are grown in certain countries for special purposes. Thus the soya bean and ground nuts are sources of valuable edible oils; the indigo plant of India produces a valuable dye from its roots; many acacias are rich in tannin, which is contained in the bark of the plant; the liquorice of commerce is obtained from the roots of a legume known as *Glycyrrhiza glabra*; many of the crotalarias contain a valuable fibre in the stem. Other legumes again are poisonous to animals, as for instance the laburnum in Europe, and stiff-sickness bush (*Crotalaria burkeana*) in South Africa. Most of these have from time to time been tried at the Agricultural Experiment Station, Salisbury, but the results obtained have not been such as to warrant our commending their propagation on a commercial scale.

Cultural Notes on Leguminous Crops.--Legumes are usually grown for grain, for hay or fodder, or as green manuring crops.

Occasionally a crop may be used for all these purposes. Up to the present time in Rhodesia they have not been grown to any extent for the other purposes mentioned above. From what has been said of their value as soil renovators it is not generally usual to apply manure or fertiliser directly to these crops. They respond well, however, to improved soil conditions, and potassic and phosphatic fertilisers are frequently recommended in special cases where the soil requires these food elements. With regard to cultural treatment the leguminous crops may be divided into classes in which treatment will broadly be more or less identical.

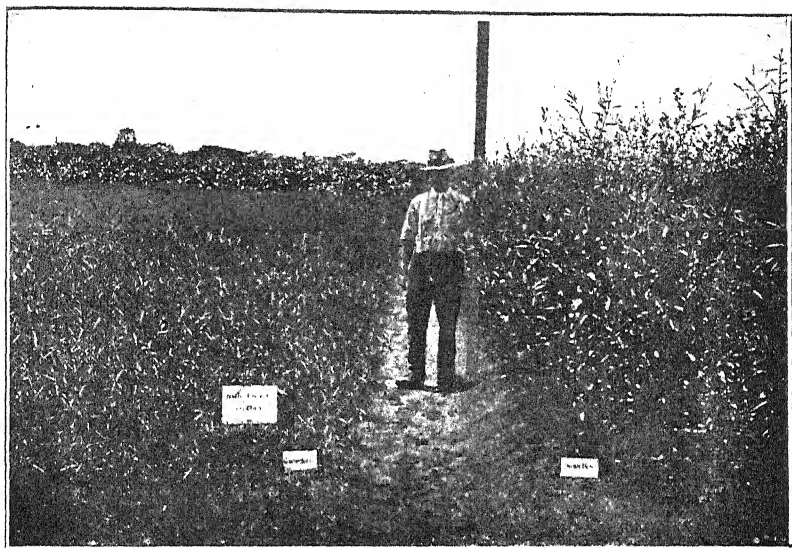
Grain Crops: Vines.—To this class belong the velvet bean, dolichos bean, cowpea, kaffir bean and sword bean (*Canavalia gladiata*). These crops are usually sown in rows sufficiently far apart to enable the vines to cover the ground completely. A distance of 3 feet apart in the row, with about 9 inches between the plants, suffices for this. They thrive in a wide range of soils, and are frequently of particular use in renovating poor sandy or exhausted soils. As in almost every case they are long season crops, planting should be undertaken as early as the season permits. About 20 to 30 lbs., according to the size of seed, suffice to plant an acre at the above distances. When grown for grain it is necessary to delay cutting until the pods are mature, but it is not unusual to remove a good deal of the vinous growth as hay earlier than this, allowing a certain quantity only of the numerous pods to attain maturity. Cultivation follows the usual lines, being directed principally to the suppression of weeds, and need not be continued once the vines meet in the rows.

A good crop of green vines will weigh from three to five tons per acre, yielding from $1\frac{1}{2}$ to 2 tons of dry hay. For ensilage the tops may be cut at any stage after reaching full growth, and are best used for this purpose in conjunction with maize, kaffir corn, Napier fodder, or grass of any kind.

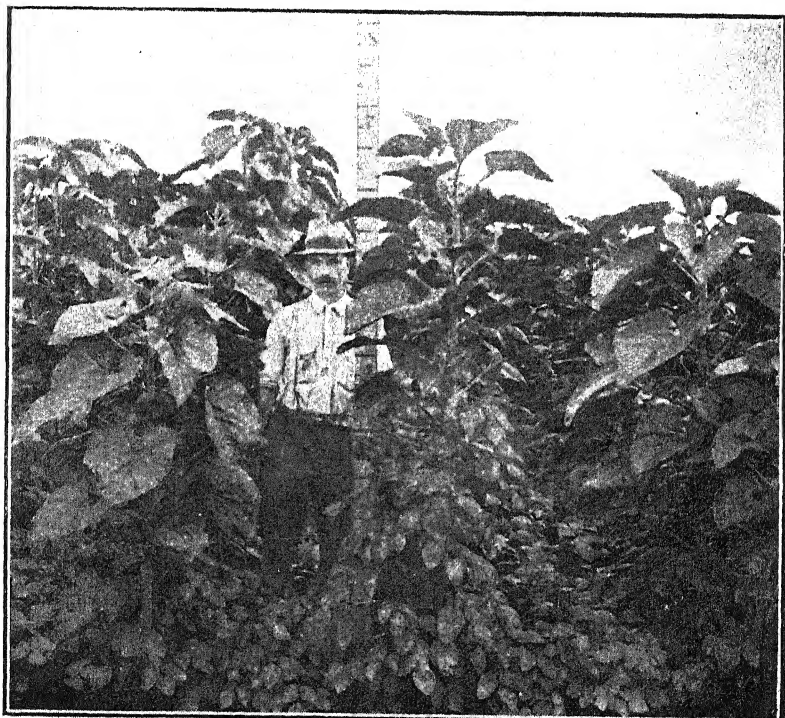
Cowpeas in Rhodesia are subject to the attacks of a stem maggot, which injures the plant just below the ground. Owing to this the crop has hitherto failed to produce results comparable to those obtained in other countries, where it is rightly considered one of the finest of the leguminous crops. New varieties recently introduced and now under trial at the Agricultural Experiment Station, Salisbury, have proved extremely promising, particularly the variety known as "Victor." The ordinary kaffir bean—an unselected form of cowpea—is more resistant to this pest, and as a rule gives better results than the cowpea.

The value of sword bean pods as a vegetable has been noted in the *Rhodesia Agricultural Journal* for June, 1922, page 344, and the use of velvet beans by natives for the same purpose is described on page 341 of that issue.

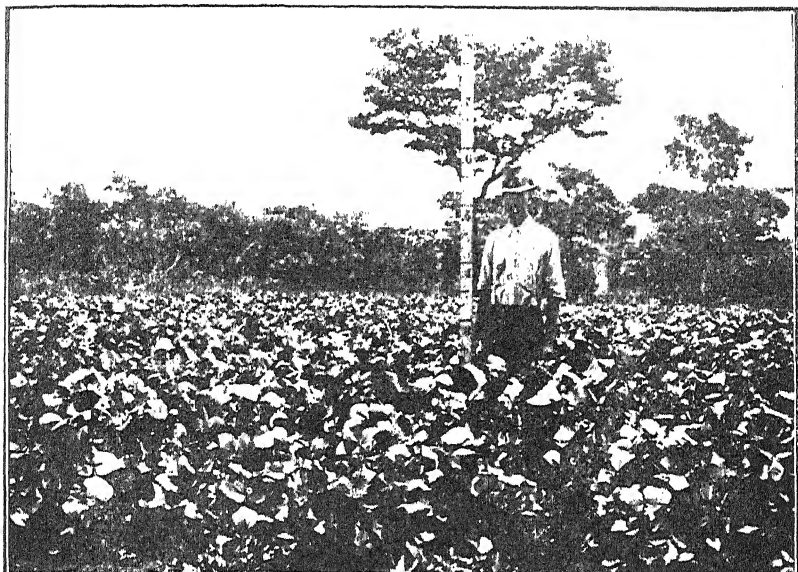
The kudzu vine (*Pueraria thunbergiana*) is included in the vine class of legumes, but differs from the above in that it rarely produces seed in Rhodesia, and is consequently grown almost exclusively for fodder or ensilage. A trial plot at the Agricultural Experiment Station, Salisbury, yielded a total of 34,722 lbs. of green fodder in four cuttings



Native legume (*Crotalaria intermedia*) on left, Sunn hemp (*Crotalaria juncea*) on right, Agricultural Experiment Station, Salisbury, 1923.



Sunflowers and velvet beans for ensilage, Agricultural Experiment Station, Salisbury.



Bush velvet bean, a new upright variety now being tried at the Agricultural Experiment Station, Salisbury.

from September, 1921 (after one irrigation only), to May, 1922. An article dealing with its propagation appeared in the issue of the *Rhodesia Agricultural Journal* for August, 1922. An article on the velvet bean appeared in the issue of the *Rhodesia Agricultural Journal* for February, 1922.

Grain Crops: Bush Varieties. In this class are included the various haricot beans, lentils, soya beans, tepary bean, ground nuts, gram or chick pea, and Jack bean (*Canavalia ensiformis*). Field peas and dhal may also be included here. These legumes as a rule do not usually produce vines, or if they do, only to a limited extent. They can, consequently, be grown in rows more closely spaced than is advisable for the runners, as the object in this case is almost exclusively the production of grain. Consequently the rows should be about 24 inches apart, with not more than 6 inches between the plants, the only exception being the dhal bean, which, on account of the height to which it grows, is best planted in rows 3 feet apart. The quantity of seed required will vary, according to size, from 20 lbs. to 60 lbs. per acre. For remunerative yields of grain it is essential that good stands should be obtained, and the primary object of cultivation should be directed to obtaining a good tilth to this end. This class of legume is medium early in maturing, and may, therefore, be sown up to the end of December. The only exceptions are dhal and Jack beans, which require a full season for maturing, and should be planted as early as weather conditions permit. An article dealing particularly with the ground nut appeared in the issue of the *Rhodesia Agricultural Journal* for April, 1922.

The tepary bean is remarkable for its drought-resisting qualities, and during the dry season of 1921-22 a crop sown early in January, and which received only 7 inches of rain, gave a yield of 840 lbs. of clean beans per acre. During the unusually wet season of 1922-23 the crop has frequently been a complete failure.

Hay Crops. This class includes lucerne, clovers, vetches, medilots or sweet clovers, and beggar weed, all grown exclusively for fodder either in the form of pasture and hay, or less frequently for ensilage. This is the class of crop that occurs frequently and so advantageously as a natural constituent of pasture in other countries, and which on account of its great value is so frequently incorporated in prepared pastures. Other plants of this class which have been tried in Rhodesia are sainfoin (*Onobrychis sativa*), sulla (*Hedysarum coronarium*), goat's rue (*Galega officinalis*), serradella (*Ornithopus sativus*), Japanese clover (*Lespedeza striata*), gacia (*Cytisus* spp.), tagasaste (*Cytisus proliferus*) and tree lucerne (*Medicago arborea*). In some of these cases good results were obtained the first season, but usually they failed to survive Rhodesian conditions for any length of time.

Lucerne has been successfully grown where there is a sufficiently deep soil or porous sub-soil to enable its roots to penetrate downwards freely. A clayey or otherwise impervious sub-soil produces the conditions known as "wet feet," which is so fatal to the lucerne plant, as it causes rotting of the roots. In naturally suitable localities, such as is

frequently found near river banks, where alluvial silt has been deposited, the crop is likely to grow without difficulty. Under the more commonly prevailing conditions thorough preparation of the soil is necessary by deep ploughing and liberal manuring. This will enable the crop to thrive for several years at least, but eventually experience has shown that as the plants gradually die out—probably as the roots reach an impervious sub-soil—re-ploughing and re-planting will be necessary.

The seed may be sown in drills 12 to 18 inches apart, or may be broadcasted. In the former case 12 to 15 lbs. per acre will suffice, in the latter 20 to 30 lbs. will be necessary. Treating seed or soil with preparations to promote bacterial growth, such as Farmogerm, etc., has not yet produced any definite beneficial effects in the trials conducted to determine this point at the Agricultural Experiment Station, Salisbury. The two varieties that have done best so far are Provence and Hunter River.

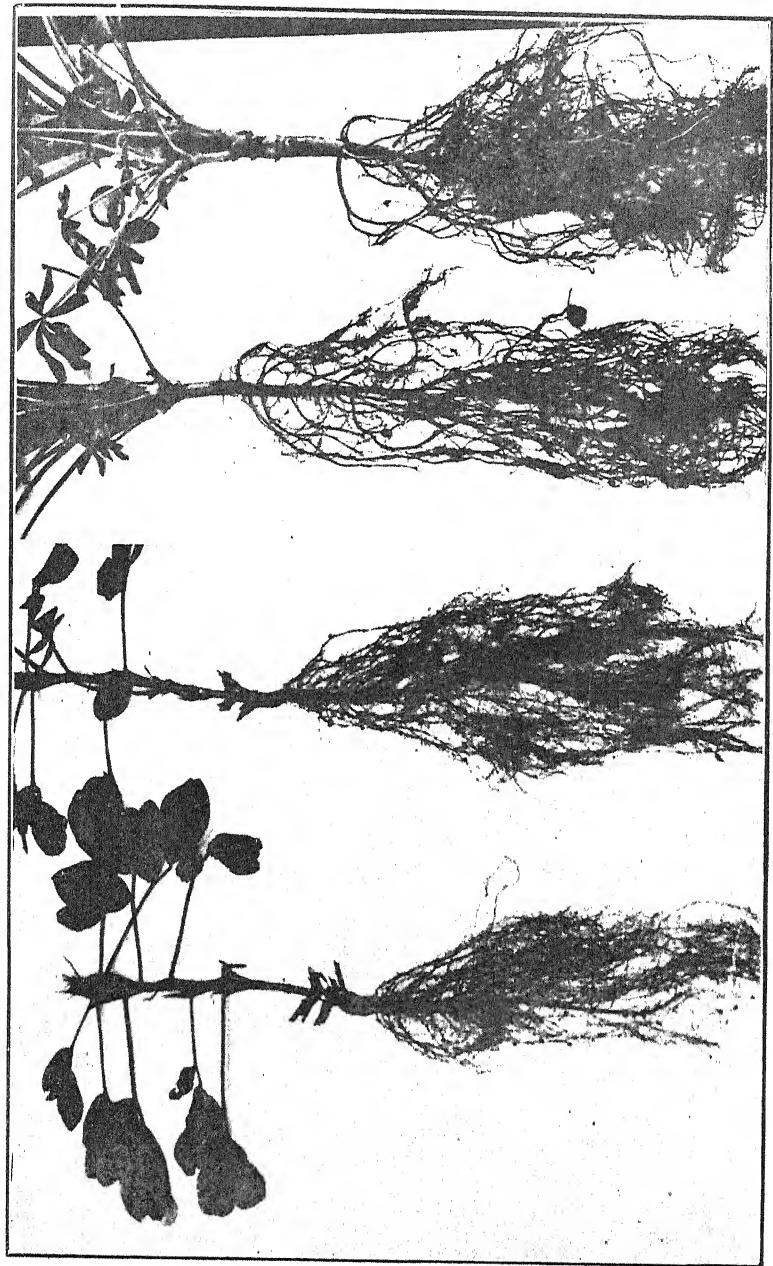
Clowers have not done well under Rhodesian conditions, with the possible exception of Egyptian clovers (*Berseem*), which have produced light yields as annual crops. They very rarely survive to the second season under any conditions, and are therefore not recommended for this country. Among the many varieties that have been tried may be mentioned strawberry clover (*Trifolium fragiferum*), Japanese clover (*Lespedeza striata*), Lombardy clover, Alsike clover (*Trifolium hybridum*) and wild white clover. None of these can, however, be recommended for general use in Rhodesia at present.

Fetches have done well as winter crops under irrigation either alone or combined with oats or barley for hay or green fodder.

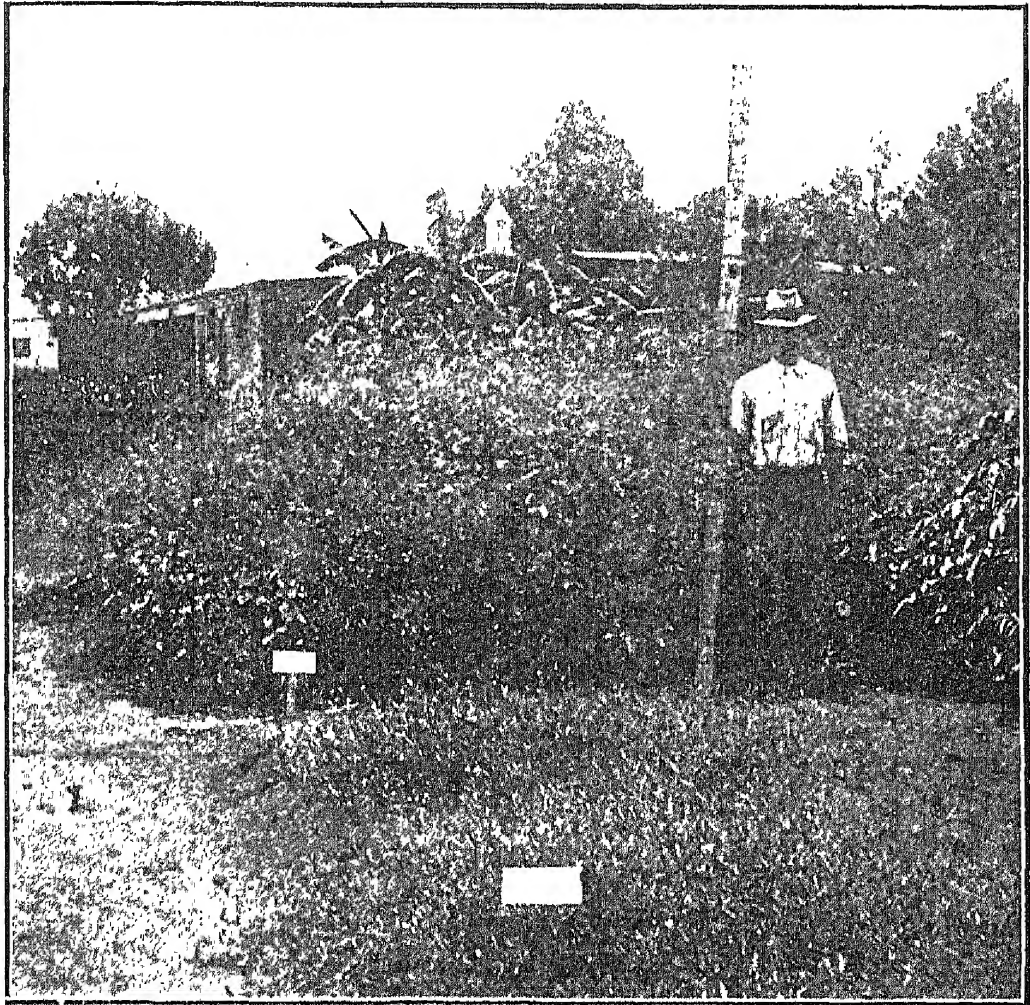
Melilots or *sweet clovers* usually last for two years, and are recommended for their heavy yield of fodder under conditions that are usually considered too poor for lucerne. Hubam clover is a variety of melilot, but has not given the gratifying yields in Rhodesia that are recorded in the Union of South Africa. Selections from vigorous plants are now being made at the Agricultural Experiment Station with a view to obtaining strains that may be suitable to Rhodesian conditions.

Beggar weed (*Desmodium tortuosum*) has proved extremely well adapted to Rhodesian conditions, growing sturdily and seeding freely on almost every variety of soil. Being a perennial plant, lasting at least five years in this country, it promises well to become an important constituent of our pastures, for which purpose it seems well adapted. In a pure stand it thrives under conditions that are unsuitable to lucerne, and if irrigation can be practised considerable winter growth can be obtained. The method of planting and rate of seeding are similar to those for lucerne. New varieties of beggar weed are now under trial at Salisbury, in which the plant grows to a height of 6 feet, but their ultimate value for Rhodesia has yet to be proved.

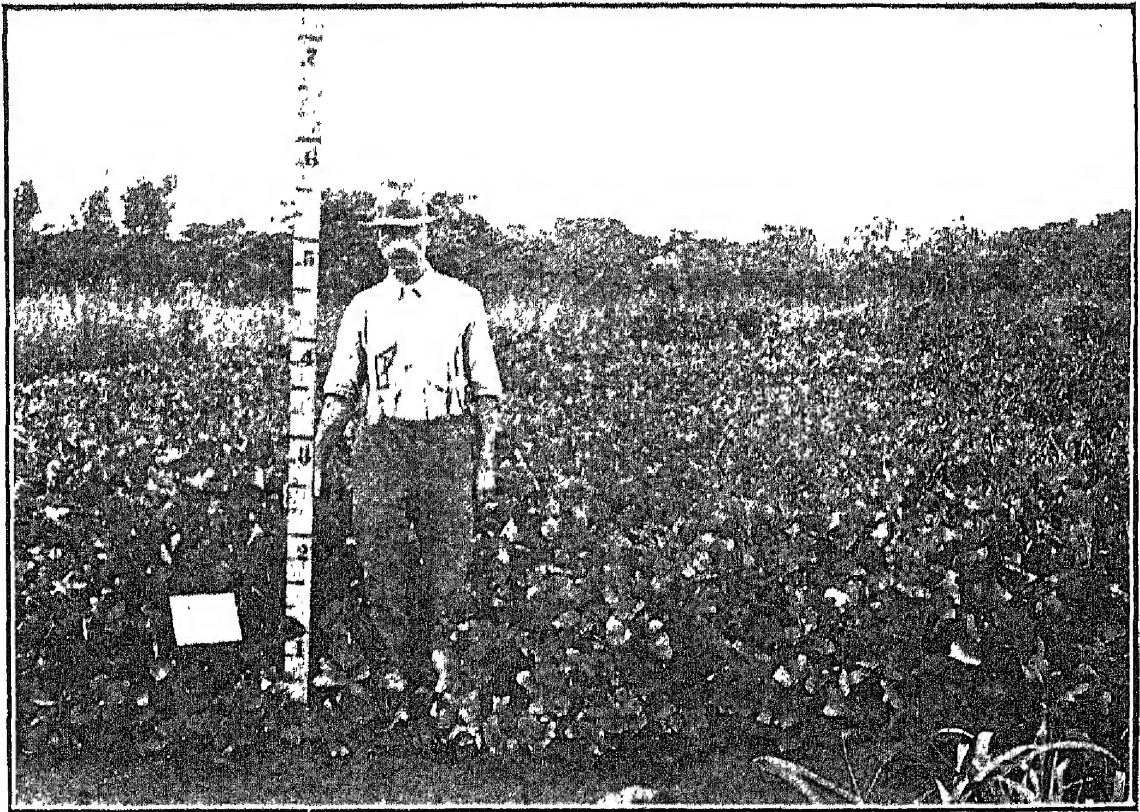
Green Manuring Crops.—As has been stated above, a great variety of leguminous crops may be used for green manuring in addition to providing returns of hay or grain. Some legumes are, however, used exclusively for green manuring on account of their peculiar value for



Nodules on the roots of leguminous plants. Numerous small nodules on the ground nut. Fewer but larger nodules on the lupin.



Giant beggar weed with Rhodesian lucerne (*Hyssicarpus* sp.) in the foreground, Agricultural Experiment Station, Salisbury, 1923.



Kudzu vine in its fifth year at the Agricultural Experiment Station, Salisbury, March, 1923.

this purpose as judged by their effect upon the succeeding crop. Such are Sunn hemp and lupins. Luxuriant growth, combined with prolific nodule production, is essential in such a case. It is also desirable that the plants rot readily in the soil when ploughed under. On account of the tendency in masses of green stuff when ploughed under to produce acidity of the soil, dressings of wood ash or lime are frequently recommended in addition, although it must be remembered that certain crops, like maize, will tolerate a considerable amount of soil acidity.

Green manuring crops are recommended on worn out soils, on naturally poor soils, and as a definite part of a system of rotation, to prevent the undue exhaustion of soils. As a rule the farmer is chary of growing a crop exclusively for this purpose involving the loss of a whole season, and where soil exhaustion is not very advanced it may not be necessary. The advantage of ploughing in the whole crop may, however, be very considerable, and experiments are now being conducted with several of our native legumes, such as species of *Crotalaria*s and *Sesbania*s, which seed freely, and which can, therefore, be grown more cheaply and economically than imported crops. The possibility of growing sesbania as a summer crop on the wet vleis where it occurs naturally, and which are intended for winter crops, should not be overlooked. These sesbanias grow and seed freely on our vleis in summer, and are remarkably prolific in nodule production. Heavy growths of these plants could be promoted at little expense by the simple expedient of scattering the seeds and lightly cleaning the land of less useful plants. Three species of *crotalaria* are now under extensive trial at the Agricultural Experiment Station, and have been selected for their hardiness, their free growth of leaf and seed, and their capacity for nodule production. The most promising is *Crotalaria intermedia*. There are doubtless other native plants that may prove equally useful, and much remains to be done in this direction.

From what has been said it is obvious that the Rhodesian farmer has at his disposal a wide variety of legumes for the varying needs of his farm. It only remains to be emphasised that he should deliberately see that they be granted their proper place on the farm, and should not rest content until a definite proportion of his annual crops and of his pasture is occupied by leguminous crops in one form or another. Such a course will help to maintain his soil fertility, to increase the yield of his crops, and to keep his cattle in better condition by enabling them to be fed with properly balanced rations from the varied foodstuffs at his disposal.

The Cattle Industry.

The most authoritative and reliable information procurable in regard to the position of the beef industry is contained in the annual Review of the Frozen Meat Trade, the thirty-fifth annual number of which has just been received. Nothing more reliable and candid exists, and we quote the following extracts, premising only that the report also deals at length with the mutton trade and with the position in all the more important consuming and producing countries of the world, and that the passages quoted are accordingly not consecutive, but scattered over the whole of the lengthy review.

At the outset we read:—

“During the twelve months reviewed in these pages the frozen and chilled meat import trade passed through a period of great difficulty and uncertainty. The staggering collapse in prices which occurred in 1921 had such serious consequences in all sections of the industry that the events of the past year might, taken as a whole, be looked upon as a hard but by no means hopeless struggle to recover from the shattering effects of that disaster. On the part of all engaged in the trade a praiseworthy effort was made to bring costs, charges and prices into line with the new conditions ruling. Caution was the watchword in every department. With so many changes taking place in various directions—changes in values, from artificial to stable and economic levels; changes in consumptive demand, from one class of meat to another; and changes in the volume, character and direction of supplies—a prudent and unspeculative policy was the only possible means of avoiding further pitfalls. Signs are not wanting, however, that the worst of the crisis is now past. Providing a solution of the present Continental problems can be found, and the promised trade revival materialises, there is every reason to hope that the industry may now go forward to a more prosperous condition of affairs for all concerned.

“So far as prices are concerned, the record of the past year presents many unsatisfactory features; but although on the average values were lower than in 1921, in most cases they were distinctly higher than the average of the last three months of that year.”

“In the producing countries, the heavy losses sustained by growers, especially cattle-raisers, in consequence of the slump in the value of their stock, prompted many of them to put forward various proposals for Government assistance, several of which received legislative sanction during the past year.

“The Argentine estancieros were loud in their clamour for nationalisation of the meat export trade, and other slightly less drastic measures. In Canada, the agitation for the removal of the British

embargo on Canadian store cattle at last had its reward. The Australian squatters received from their Government a subsidy of ¼d. per lb. upon all cattle killed last season, which, together with reductions in freezing and other charges, enabled them to weather the storm for the time being. Finally, the New Zealand Government's Meat Export Control Act was passed, giving a Board of live stock producers and Government officials almost unlimited powers to control the handling --from the farm to the retail shop--of the whole of the meat exported from the Dominion. This scheme, which was greeted with disapprobation and continued protest on the part of most sections of the trade, has not yet been put into full operation."

The Review goes on to deal with supplies and prices:-

"A heavy decline occurred in receipts of frozen beef, the total for the year amounting to only 2,601,726 quarters against 5,108,900 quarters in 1921, a reduction of 2,507,174 quarters or 49 per cent. There was no increase from any source. Australia's contribution was reduced by 376,770 quarters and New Zealand's by 242,929 quarters. The Argentine total of 1,302,438 quarters was slightly less than half the 1921 figures, while from Uruguay and Brazil the decreases were 353,817 and 60,353 quarters respectively. Canada sent 296 quarters against 4,335 quarters in 1921, and South Africa 4,092 quarters against 7,735 quarters in 1921.

"Although frozen beef arrivals were cut down by half, a counter-balancing increase has to be recorded in chilled beef imports, which amounted to 3,516,350 quarters, as compared with 1,883,362 quarters in 1921, an increase of 1,632,988 or 86.6 per cent. Argentina shipped 1,323,058 quarters more than in 1921, and Uruguay 316,834 quarters more. A single shipment of 140 quarters represented Canada's effort, against 5,003 quarters in the preceding year.

"It will be noted that, while the increase in the number of chilled quarters is 86.6 per cent., the weight of chilled beef received last year shows an increase of 99 per cent. This is explained by the heavier average weight of the quarters imported in 1922 as compared with 1921."

"Frozen beef quotations showed much more stability than those of either mutton or lamb, but that was because the overstocked condition of the market prevented any material advance from rock bottom. The demand was dominated largely by the variations in the supply of chilled beef. When chilled was scarce, buyers turned on to the better qualities of frozen, but when supplies of chilled became plentiful, the trade in frozen beef almost ceased. Opening at 6d. per lb., Argentine frozen hinds dropped 1¼d. per lb. in January and February, but recovered gradually during April, May and June, and remained steady at about 5½d. to 5¾d. until the end of October, when extra heavy supplies of chilled brought the price down to 5d., at which level it remained until the end of the year. Australasian hinds opened at 4¾d. per lb., but dropped to 4d. in February. Recovering to 5d. in the autumn months, the price fell away again in the latter part of the year, finishing up at 4½d. per lb. Values of Argentine fores and Australian crops

were fairly steady throughout the greater part of the year at about 3½d. per lb., but sellers of New Zealand fores had to take lower prices during April, May and June on account of the stale condition of much of the beef offered. The average price of New Zealand forequarter beef for the whole year was actually under the 1913 figure. In November, however, a distinctly better demand set in for forequarter beef, and a general advance of 3d. per lb. took place before the year closed.

"Chilled beef prices, which began the year at 7½d. and finished at 6½d. per lb. for hindquarters, ranged between 5d. and 8½d. per lb., with the usual violent fluctuations, due to the necessity for clearing supplies quickly. The lowest levels were touched in February/March and again in October/November, while the best prices were secured in March, April, June and September.

"The prices obtainable for chilled forequarters seldom rose more than a fraction above the quotations for Argentine frozen fores, and in many cases were lower.

"In view of the enormous increase in imports of chilled beef last year, it is not surprising that a considerable proportion failed to reach the usual chilled beef standard of quality, while the condition of many of the shipments left much to be desired, the chief defect being that the beef showed signs of having been slightly frozen."

After dealing with freights and storage, the demand in different countries is discussed, from which we find a curtailed consumption of foreign meat generally and of frozen beef in particular owing to a combination of economic causes, notably trade depression and unemployment, political unrest and increasing local supplies, and heavy killings owing to droughts in parts of Europe. The only country which apparently would import if it could is Germany. The Review states:—

"While it cannot be said that the meat import trade in Germany made any progress during the past year, a good deal of organising work was undertaken by the importing firms with a view to more extensive developments in the future. So far as can be ascertained, these efforts appear to have been fairly successful, and the groundwork of a more extensive business has now been laid, in anticipation of an early return to more normal business relations.

"In the first few months of the year there was very little business done in frozen meat, and the few sales made consisted chiefly of old stocks in stale condition; but towards the end of March a strong demand suddenly set in, and extensive shipments were immediately arranged from London, followed by direct shipments from overseas. Later on, the sale of frozen meat was more spasmodic on account of the sudden fluctuations in exchange.

"There appears to be no doubt that Germany for some years to come will be dependent upon imports of frozen meat, for the reason that the live stock in the country, although recovering slightly, are still considerably fewer than in 1913. Had it not been that the depreciated value of the mark has so lowered the purchasing power of

the average German that the consumption of meat in general is now only a fraction of what it once was, a serious shortage of meat supplies would undoubtedly have made itself felt during the past year.

"Although it may be taken for granted, therefore, that Germany will continue to import frozen meat, it is quite manifest that a real, steady-going trade will not be possible until the German financial situation is stabilised.

"Frozen meat, having to be paid for on a gold basis, is now very much dearer than fresh meat produced in the country, the export of which is strictly prohibited.

"Imports for local consumption last year amounted to approximately 21,000 tons of beef and 1,100 tons of mutton, against 40,000 tons altogether in 1921 and 80,000 tons in 1920. In addition, several thousand tons were re-exported to other Central European countries."

In regard to sources of supply, the present position of South Africa is insignificant, with an export in 1922 of only 300 tons compared with 950 tons in 1921, 5,645 tons in 1920 and 19,942 tons in 1919.

"The world's present supplies of beef, in the form of cattle, are undoubtedly in excess of the present demand; but last year's prices were below the cost of production, and that is a state of affairs that can only continue for a limited period. The business must show some profits, otherwise supplies will eventually fall off. A profitable stage must be reached by means of reduced cost of production, lower freezing, handling and transit charges, or some expansion in the demand. The reductions which took place last year in charges of all kinds afforded an appreciable amount of relief, and prime costs are doubtless following suit, but unfortunately the demand for beef has contracted seriously.

"To a certain extent this is due to the poor quality and stale condition of much of the frozen beef shipped to this country since the war. Although the old war stocks are now cleared away, and some improvement has been noticeable in the fresh arrivals, producers would do well to bear in mind that the public have become much more fastidious as regards the quality and appearance of the meat they buy."

"The foregoing observations are made of course on the assumption that political troubles in Europe and financial negotiations with America will progress steadily towards a satisfactory settlement; that the general trade of the British Empire will continue on the upward grade, and that unemployment in this country will gradually decrease."

The Review concludes with the following words of hope:

"It would seem that for the time being the downward trend of food prices has almost come to an end. Provided the general trade of the country is not upset by any further complications, the average prices of imported mutton and lamb in the coming year are not likely to be lower than those of last year, while the average of beef prices may show considerable improvement."

A report by the Committee of Enquiry into the Cattle Industry of Southern Rhodesia is eagerly awaited by all farmers, and there is

reason to hope that it may be issued at an early date. This report cannot add much to what the stock owner knows of the position, but it is hoped that it may indicate means which Government may take to alleviate the present position, and that it may serve to attract those who are concerned in the meat trade of the world and induce them to provide the necessary facilities for the export of our surplus beef.

It will have been noticed that the Union Government has proposed to grant subsidies on frozen beef exported overseas, a step involving corresponding action on the part of Rhodesia and the native Protectorates of South Africa. This subsidy must have a generally beneficial effect on prices in which all participate. If the Union exports subsidised meat and replaces this with the Rhodesian article, we obtain the very much desired outlet. Similarly, if some of the best cattle go overseas because of the bounty, others as good become saleable locally, and the prices of all classes rise. To trace and convey the bounty to the original breeder cannot be in most cases practicable even if it were necessary, but the general effect of the new proposal must reflect beneficially on the whole cattle industry.

At the Agricultural Union Congress in Bulawayo the General Manager of Railways made the welcome announcements of reductions in railway rates on live stock sent to Johannesburg and on fencing material. The fact remains that the cost for so long a journey as to Johannesburg from Bulawayo or beyond must, even at reduced rates, be a heavy item, for the service rendered is also considerable. True economy lies in establishing meat works near to the grazing ground of the animals, thus saving both freight and weight, for the loss of flesh and fat on such long journeys and the deterioration of the animals by bruising and fatigue are also serious causes of loss.

The Planting and Care of Hedges.

By J. S. HENKEL, Forest Officer.

Introduction.—The privacy and comfort of any home, be it on a farm, a mine, or on a town or suburban plot, depends as much on its hedges as on any other detail of its design and lay out. A home is something more than a shelter or a place to eat and sleep in. It should be attractive, a haven of rest and a retreat. The dwelling, though built only of wattle and daub or Kimberley bricks and covered with a roof of thatch, or consisting of some Kaytor huts, may have its surroundings made beautiful and attractive by a judicious planting of trees, shrubs, flowering plants and hedges. Beauty in every form has an influence for good, and it is well known that children especially are wonderfully affected for good or ill by their surroundings.

In Southern Rhodesia there are comparatively few homes where attempts are not made to improve the surroundings. There is, however, abundant scope for much greater effort than has hitherto been displayed. The thought and work given in improving the surroundings is a positive relaxation and recreation, and as the rate of growth of the plants generally used is rapid, the pleasure of contemplating the result of one's labours is not long delayed. Beautifying the home tends to make both young and old more contented, and materially adds to the enjoyment of those who pass by, and thus incidentally to the selling value of a property.

Efforts to beautify the home surroundings are often misdirected, and in no case is this more apparent than in the lay out and care of hedges. The causes of this are chiefly lack of knowledge of what can be accomplished with a little effort and the idea that it will require much time and work or be too expensive.

Need of Hedges.—Hedges are required for two main reasons, namely, as a fence and for ornament. As a fence a hedge is a barrier to exclude cattle, dogs or other animals, and afford shelter from wind, and to give privacy. As an ornament, to act as screens for buildings or unsightly objects; as screens between town lots; to divide portions of gardens, and for low boundaries to paths and drives. In practice hedges frequently combine the utilitarian with the ornamental.

Definition of a Hedge.—Briefly a hedge may be defined as a row or very narrow belt of trees or shrubs, kept from spreading too widely or from attaining too great a height, and intended to serve any of the purposes mentioned in the previous paragraph. From the nature of

the uses of a hedge it is difficult to say when they are borders or hedges.

Characters desirable in a Plant to be used for Hedging Purposes.—The chief characteristics of a plant to be used for hedging purposes are:—

- (1) to produce a hedge in a reasonably short time;
- (2) to be easily kept within suitable bounds;
- (3) to have a compact form, dense foliage, and closely arranged branchlets;
- (4) to be adaptable to various situations;
- (5) to be hardy, *i.e.*, frost and drought resistant;
- (6) to have a tendency to produce shoots near the ground;
- (7) not to harbour insects;
- (8) not to produce suckers;
- (9) to bear frequent pruning and clipping;
- (10) to have a long life.

When used as a fence an additional quality is that it should be strong and be provided with thorns or prickles. A well-kept thorn hedge may be ornamental as well as useful. While not possessing all the qualifications specified, a large number of plants are adapted for forming hedges, and the suitability of each depends upon the purpose for which it is required. Various localities and soils may require the use of different species.

Location of Hedges.—The place for a hedge depends upon the objects sought to be attained. In some instances hedges may be replaced by shrubbery or by trees or belts of trees permitted to grow and develop in a natural manner. Personal taste must determine very largely what will best suit any given locality or situation.

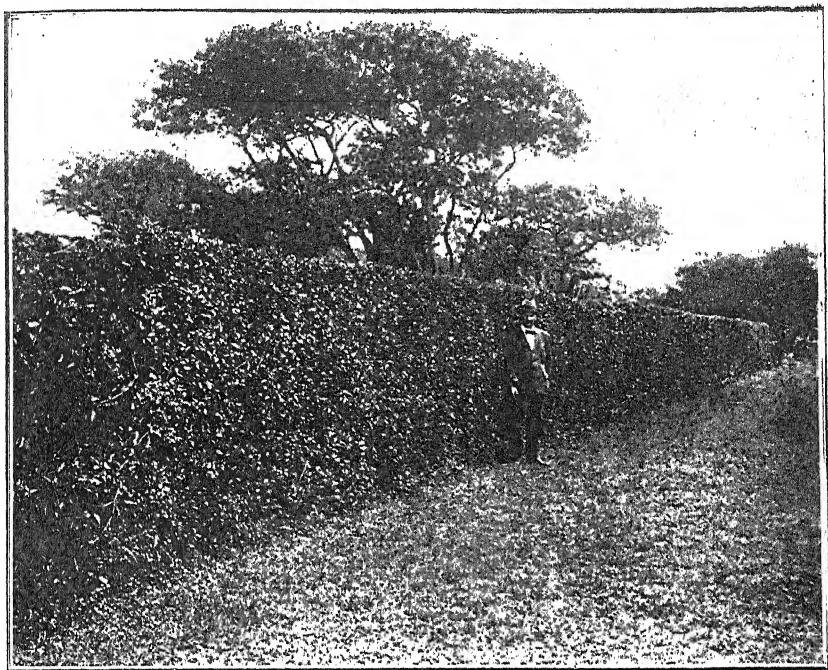
On a farm hedges may be required along the outer boundaries next to wire fences, or along the boundaries of paddocks chiefly as barriers or as shelter from wind. When used as barriers plants having thorns or strong prickles are desirable, and may be used in conjunction with shelter belts of trees.

At the homestead as screens separating the ornamental grounds from the vegetable garden, and generally to screen off native quarters, sheds, stables or other buildings.

In town or suburban plots where space is limited and the most must be made of available land, great care is required in planning the lay out of the grounds. Generally hedges should be used:—

- (a) to screen off the vegetable garden from the rest of the grounds;
- (b) as screens between adjoining plots for the sake of privacy;
- (c) to screen off or conceal servants' quarters, garage, or any unsightly parts;
- (d) to define low boundaries to paths and sections of the garden.

Usually there should be no tall hedge on the street boundary unless one is absolutely necessary as a wind or dust screen. A beautiful garden should be seen by the passers-by. Many town plots are



Photograph No. 1. A well-trimmed rectangular hedge, Salisbury, of Plumbago (*Plumbago capensis*), 6 feet high and 2 feet deep.



Photograph No. 2. Neglected hedge of Kei apple (*Doryalis caffra*).

not sufficiently large to maintain trees and hedges as well as flowering plants. In such a case it is better to dispense with a hedge.

Where sidewalks of streets are not gravelled, as is the case in some of the residential portions of Salisbury, the practice followed by many citizens of turfing the sidewalks adjoining their plots and properly maintaining the grass by frequent mowing and rolling deserves to be more extensively followed. The pleasing effect of a well-trimmed hedge with adjacent sidewalk is well illustrated in the accompanying photograph No. 1.

Preparation of the Soil.—If hedges are to fulfil the objects sought to be obtained, it is necessary to prepare the ground in a thorough manner. It is the indifferent preparation of the soil that is chiefly responsible for the many bad hedges noted throughout the Territory.

For the farm boundary hedge it is desirable to plough and cultivate the length required to a width of 6 to 8 feet, and plant the hedge in the middle of the cultivated strip. If a wire fence is in existence or proposed to be erected, the cultivated soil should extend to both sides of the fence, or a trench may be dug 2 feet deep and 2 or 3 feet wide and filled in with good top soil.

Where space is limited, as in town or suburban plots, dig a trench 2 feet deep and 2 feet wide, and have the contents thoroughly well pulverised. If available, replace the sub-soil taken out of the trench with good top soil. Where the soil is poor, use a little bone fertiliser at the rate of 5 lbs. to every 10 feet. The trenches should be dug well in advance of the time of planting, so as to aerate the soil. If this is not possible, the excavated soil should be well worked and firmed before planting. It is advisable to have the hedge bed a little higher than the surrounding land.

Good hedges may be obtained from untrenched soil, but experience is strongly in favour of trenching.

Planting Distance.—Opinions differ as to whether hedge plants should be set in a double or a single row. If a double row is used the plants should break joint, *i.e.*, the plants in the second row should be placed opposite the middle distance of the plants in the first row. All things being equal a single row is to be preferred, as this gives the plant equal freedom to develop on the two opposite sides.

For hedges intended to be a foot high or less the plants should not be placed more than 4 inches apart; for hedges 3 or 4 feet high the plants should be 6 to 12 inches apart, and for hedges 6 feet high not more than 18 inches apart.

Planting.—Hedges may be formed by sowing seed *in situ* of the species desired, or simply formed by planting cuttings where they are required to grow. Usually, however, hedges are established by using rooted cuttings, seedlings or transplants.

When seed is used the bed should be well cultivated and reduced to a fine tilth so as to obtain the best results.

Cuttings should be about 12 inches long, cut from good healthy wood and planted with a slight slope, usually only leaving about two

inches above the ground, having if possible two nodes from which buds will start.

When planting seedlings or transplants it is important to place the roots in the ground in such a manner as will encourage growth. All species should be planted at the same depth as they stood in the nursery beds or trays. Failure to observe this rule not only leads to losses, but to irregular growth as well. When using plants with no earth round their roots first give all roots a clean cut, then place the plant as deeply as it will go in the hole or trench, spread out the roots in a natural position, and gently raise it to the correct height as the hole is being filled, thus straightening the roots. The soil should be made firm round the roots with the aid of the fingers or preferably a rammer. This practice excludes the air and aids growth considerably.

If the plants are in trays they should be carefully removed by means of a gardener's trowel, retaining as much earth as possible round the roots. Place each transplant into the hole dug for the purpose, slightly above the correct height to allow for the sinking of the soil, fill in earth closely round the ball of earth, leaving no air cavities, firm with the fingers of both hands, and finish off with further firming with the feet. After the plant has been planted make a small saucer-like depression and water at once to settle the soil. Open-rooted plants should similarly be watered as soon as planted. Avoid all unnecessary exposure of the roots to air and sunlight.

The plants to be used should be carefully chosen. As far as possible the seedlings, transplants or rooted cuttings should be of equal height, strength and vigour. If plants of unequal size are used a perfect hedge cannot be secured, for the weaker plants will never catch up to the stronger ones. Within limits the smaller the plants used the better will be the resulting hedge. Plants which have been transplanted several times probably have lost some of their lower branches or otherwise suffered by having their roots crowded in a tray or nursery bed.

In planting a hedge one of the main objects is to secure a full base, *i.e.*, numerous branches and branchlets close to the ground. To secure this cut back severely to a uniform height above the ground so as to induce the desired bushy growth.

Filling Blanks.—In setting new hedges, though every care is taken in planting, it is possible some blanks or vacancies may occur. For this contingency provision must be made by keeping in reserve a supply of the same age plants. As soon as vacancies are noted replace with strong vigorous plants. If this is not done gaps will occur which will always be weak spots in the hedge.

Outline or Shape.—Generally the outline or shape of a hedge should be that of a plain triangle or the more shapely curvilinear or Gothic arch. Hedges should not be trimmed too closely, for a little irregularity gives a natural and beautiful appearance, but this should not be taken to mean, especially in a town or suburban plot, the generally neglected appearance of hedges as shown in the subjoined

photograph No. 2. Compare this photograph with the one showing a well cared for hedge.

The advantages of the curvilinear or triangular types is that the sun can better reach the bottom of such hedges and keep them covered with foliage down to the ground. The value of a hedge for excluding or enclosing animals depends rather on the density of the bottom than on the height. A hedge weak at the bottom rapidly weakens, while one having well developed branches low down tends to retain its vigour.

Rectangular hedges or hedges wider in the middle or at the top than at the bottom are almost sure to be without foliage near the ground unless they happen to be of a species which is a dense shade bearer.

For general purposes triangular hedges with broad bases are the best. Where, however, a high narrow hedge is required as a shield from the wind or for separating two town plots the rectangular is more suitable. Photograph No. 1 represents a good example of such a hedge. The hedge in this case is plumbago (*Plumbago capensis*), and has a height of 6 feet.

The height of hedges is a matter of personal choice, and is largely influenced by the objects sought to be attained. A hedge 4 feet to 4 feet 6 inches high will exclude cattle; one 3 feet to 3 feet 6 inches, sheep and pigs. A fence as high as an ox will break the wind, and a thick well kept one is more effective than one which has become thin at the bottom so that the wind draws through.

Maintenance and Care.—A perfect hedge requires constant care from the day it is planted. Frequent trimmings and prunings are necessary to develop a proper shape and a broad compact base. The soil round the roots of young hedges must be kept open by the frequent use of the garden fork or hoe. This cultivation should extend, where this is possible, on one or other or both sides to a distance about equal to the height of the hedge. From this it follows that it is a mistake to attempt to grow flowering plants close to a hedge. In a number of cases, however, a path will separate the hedge from portions of the garden. A space equal to the height of the hedge allows amply for root-spread. To prevent, if this is desired, the roots spreading beyond this limit, trenches to sever the roots must be cut periodically.

On the cultivated strip fertiliser, such as well rotted leaf mould, may be introduced so as to keep the hedge healthy and vigorous. It must be remembered that a considerable amount of growth takes place annually, which tends to exhaust the soil, and it is therefore necessary to provide a supply of plant food within easy reach of the roots.

Until well established all hedges used as fences must be protected from cattle. The best protection usually will be found to be a temporary fence of two or three strands of barbed wire.

A neglected or overgrown hedge may be rejuvenated by cutting away the top and branches, leaving only a bare framework, or it may be desirable to make a clean cut down to the ground level and start fresh growth from the collar. In cutting a neglected hedge into shape always cut with an upward stroke, as this gives a clean surface, water runs

off easily and little decay takes place. A downward stroke causes the wood to splinter and induces decay.

Species Suitable for Hedges.—The long dry winter of this Territory indicates that evergreen hedges should be largely used, for it is during the winter that ornamental hedges are most desired, not only for their beauty, but also for shelter from the drying winds. The subjoined list contains the more important plants adaptable for hedging. The efficiency of each is dependent on the treatment received.

1. *Evergreen Species without Thorns.*

<i>Botanical Name.</i>	<i>Common Name.</i>
Bougainvillea glabra	Bougainvillea
Buddleia sp.	Buddleia
Callistemon sp.	Bottle brush
Callitris calcarata	Black pine
Cupressus arizonica	Arizona cypress
Cupressus torulosa	Himalayan cypress
Freylinia tropica	—
Hibiscus spp.	Chinese rose
Juniperus virginiana	Juniper
Ligustrum lucidum	Japanese privet
Murraya exotica	—
Photinia japonica	Loquat
Pittosporum undulatum	Camphor laurel
Pinus halepensis	Jerusalem pine
Pinus longifolia	Chir pine
Plumbago capensis	Plumbago
Rhus lancea	Karee
Rhamnus prinoides	Blinkblaar
Thuya orientalis	Thuya

2. *Evergreen Species with Thorns or Prickles.*

<i>Botanical Name.</i>	<i>Common Name.</i>
Cæsalpinia sepiaria	Mauritius thorn
Carissa grandiflora	Amatungula
Doryalis caffra	Kie apple
Pereskea aculeata	Barbadoes gooseberry
Rosa bracteata	MacCartney rose
Rosa spp.	Roses

3. *Deciduous Species without Thorns.*

<i>Botanical Name.</i>	<i>Common Name.</i>
Duranta plumieri	Tree forget-me-not
Eugenia braziliensis	—
Lagerstroemia indica	Pride of India
Moras sp.	Mulberry
Poinsettia pulcherrima	Poinsettia
Punica granatum	Pomegranate
Spirea reevesii	Cape May
Tecoma smithii	Tecoma
Tecomaria capensis	Cape honeysuckle

Tsetse Fly.

A FOUR YEARS' EXPERIMENT IN GAME ELIMINATION.

By RUPERT W. JACK, F.E.S., Chief Entomologist.

Introductory.—The question of the dependence or otherwise of the tsetse fly (*Glossina morsitans*, W.) on the larger fauna of its habitat has been much debated of recent years. Many of the earlier explorers of South and South-Central Africa were not assailed by any doubts in this connection, and numerous extracts could be quoted from the writings of these men expressing their conviction that the fly would eventually disappear with the game. In 1894 Mr. W. Cotton Oswell ("Big Game Shooting") sums up the general opinion based upon South African experience up to that time. "The tsetse . . . will disappear before the approach of civilisation and the killing off of the game, especially the buffalo, its standing dish, as it has done so many times already in African history. I am speaking of the tracts south of the Zambesi."

Two years after the book containing the above extract was published rinderpest swept through the country and decimated the herds of most species of antelope and other ungulates, and nearly exterminated the buffalo in many parts. This occurrence was immediately followed by total disappearance of the tsetse fly from many tracts of country. The whole of the Transvaal became free from the pest, together with all the southern portion of this Territory, whilst in the north of the Territory the fly-infested country shrank to such insignificant proportions that no regard was paid to it for several years.

Neither game nor tsetse fly was, however, altogether exterminated, and a few years later both began to show signs of increase, the game in the unsettled portions of the Territory generally, and the fly in the few spots where it still lingered after the cataclysm.

The increase of the fly was accompanied by extension of its range, and this movement has in general continued steadily until the present day, except in areas where settlement has materially interfered with natural conditions. Notwithstanding the continuous spread of the pest, however, which has now continued for twenty-six years, the country infested at the present day still constitutes only a fraction of the former fly areas of the Territory.

The locality in which the increasing fly first came into contact with settlement was the Hartley district, where a belt of fly persisted in the basins of the Shagari and Suri-Suri Rivers, embracing a portion of the railway line. In consequence of this the whole of the district north-west of the railway line and north of the Umsweswe River was in 1905 thrown open to free shooting with a view to testing the theory of the dependence of the fly on big game. This area has remained open with the exception of one season (1908) until the present day. By 1912 tsetse fly had become exceedingly scarce in the Suri-Suri area, but final elimination was actually brought about by deforestation of its haunts, which commenced in 1913. With regard to the apparent success of suspending the game laws in reducing the fly in these parts, it should be noted that the infested area was very limited in extent and situated in a comparatively populous district, so that the game, after it became too scarce and shy to pay the professional hunter, was continually harried by local sportsmen.

In the more remote parts of the district near the Umniati and Umfuli Rivers, professional hunters greatly reduced the game, and apparently held the fly in check until, with the slump in the value of hides and biltong during the last few years, hunting became unprofitable, and has since been almost altogether neglected. As a consequence game has increased greatly, and is once more abundant in regions from which it had to a large extent been expelled. Fly also has recently developed a considerable tendency to spread in this region.

In the meantime the apparently successful result of suspending the game laws in the Hartley district had led to a similar policy being adopted tentatively in some other districts where the fly was extending its range, but in these the factors which favoured success of the measure in the Hartley district were lacking. There was no settlement of any extent in the vicinity of the open areas, the latter were remote from communications, and the hunters who took advantage of the suspension of the game laws directed their efforts mainly against elephant, and used the existence of an "open area" as a screen for poaching operations over a wide extent of country not infested with fly. These "open areas" were accordingly closed again, and it was decided that the policy of suspending the game laws in definite tracts of country was not calculated to effect its object unless adequate control could be exercised over the hunters.

The continued encroachment of tsetse could not, however, be regarded with indifference, as the fly was beginning to threaten parts of the country inhabited by natives with considerable herds of cattle, and even in some cases by Europeans on isolated farms. Whilst no apprehension was felt in regard to those parts of the Territory where settlement had changed natural conditions, it was obvious that more and more country was being closed to possible settlement year by year, and that large numbers of natives in some of the reserves were likely to be ruined in course of time by loss of their cattle. Under these circumstances, not only would the development of the Territory be seriously inhibited, but the economic fabric as existing at present would be materially affected.

Owing to the remoteness of the fly-infested areas, the huge extent of country involved, and, be it said, the limitations of our knowledge in regard to the life economy of the tsetse fly, no operations against the pest other than local game reduction appeared to hold out any prospect of immediate practicability. This statement must not be construed as indicating that there is no prospect of any other practicable and much less repugnant means of dealing with the pest being found in the future. If the African Governments interested in the tsetse fly problem support research in this connection in accordance with the dictates of enlightened self-interest, some far less clumsy remedy may well be discovered. In view of the urgent necessity, however, of having some means of checking the pest in particular instances, and of having data to serve as a guide to policy in connection with the local pressure which almost invariably follows outbreaks of trypanosomiasis on the edge of or close to European settlement, it was felt that the effect of game elimination should be put to a definite test. There were several points connected with the application of this measure on which it was desirable that light should be shed. The cost and duration of such operations if undertaken by the Government were altogether problematical, as also was the feasibility or otherwise of speedy elimination of "fly" by this means in any given area. Consequently it was decided that an experiment should be undertaken with a view to obtaining information bearing on as many practical aspects of such an undertaking as possible.

The necessity for experiment with a view to testing the theory of the dependence of *G. morsitans* on "big game" had been realised before the war in other parts of Africa, and recommendations had been made for an expensive undertaking with this single object in view. The plan was to surround a selected area of fly-infested country with a game-proof fence, and then to expel or destroy all the game enclosed. Provision would, of course, have been made for maintaining the fence and keeping the area free. This, it is freely admitted, would have been the strictly scientific method of procedure, but it was not adopted in the present instance on account of several vital considerations. In the first place the feasibility of maintaining a game-proof fence was questionable, and the effort to do so was judged likely to cost a very great deal of money. More important than these considerations, however, was the fact that even if such an experiment proved successful in operation and clearly demonstrated the dependence of "fly" on game, it would throw little light on the practical aspects of game control as a definite policy. Reduction in the numbers of wild animals in any area might theoretically be effected by various means, including poison, poison gas and possibly other measures, but on account of the necessity of guarding against danger to human life, the only method which can safely be put into practice on a large scale is systematic hunting with the rifle. It was resolved, therefore, to carry this out in an intensive degree in the selected area.

Area Selected for the Experiment.—The area eventually selected was the region embracing the lower Shangani River for some thirty miles above its junction with the Gwaai and including the lower por-

tions of the Mzola and Kana Rivers, the western boundary of the area being the Gwaai River.

The selection of this area was due to several considerations, chief amongst which was its proximity to the railway line. Furthermore, the fly had been extending rapidly towards the Gwaai River in a comparatively narrow salient from the big Sebungwe fly area and threatened to invade country occupied, although very sparsely, by Europeans. It was hoped, therefore, that immediate practical benefit might be obtained by checking the advance of the pest and possibly by driving it back. The area is also on the whole well watered, and this was of importance in regard to the distribution of camps. On the other hand, game was extremely plentiful, and the attraction of the area to these animals was calculated to lead to continual immigration, rendering the task of elimination very difficult. Having regard, however, to the remoteness from communications of all other fly-infested country in the Territory, the choice of this particular area was unavoidable.

The boundaries of the operations could not always be fixed with great exactitude from lack of natural features, and the plan adopted was to assign the hunters to fixed camps and instruct them to deal with all the country within hunting radius, a distance usually of some five to seven miles. Camps were scattered more thickly where game was particularly abundant, subject, of course, to the exigencies of water supply, and the camps were so arranged that all the important portions of the area were covered by the hunters.

Physical Features and Vegetation.—The physical features of the area are to a large extent shown in the attached sketch map. The Gwaai and Shangani Rivers are, of course, considerable streams, draining with their tributaries a large area of country. Within the area the Gwaai tends rather to be muddy, whilst the Shangani has a sandy bed, and in most parts exhibits in the dry season wide expanses of whitish sand. Both are subject to heavy floods during the rains, but towards the end of the dry season dwindle to a series of pools with an inconsiderable stream of water between each. The Mzola River in its lower portion is a dry stretch of sand during the dry months, but permanent water can be found by digging in at least two spots, and open water is present higher up at a "pan" beyond the limits of the operations. The Kana River is a narrow perennial stream which rises in the Kalahari sand of the Mafungabusi plateau far to the east, and runs into the Shangani. It is practically without tributaries, and is only a few feet wide even at its junction with the Shangani. It contains running water, however, at all seasons of the year, and appears to be little affected by the most severe droughts.

The vegetation of the area presents some conspicuous characteristics largely correlated with the formation. The watersheds between the rivers consist of considerably elevated areas of Kalahari sand, in some places with a definite escarpment. These areas bear forest of the type termed by the Matabele "gusu," in which the Rhodesian teak tree (*Baikia plurijuga*, Harms.; Sindebele, "Igusi") typically predominates, but has to a considerable extent been supplanted by *Brachystegia*

spp. and *Berlinia* sp., which appear to be spreading across this type of formation from the east and driving back the previously indigenous forest.* The latter contains many other trees besides the Rhodesian teak, notably the "Mchibi" (*Copaifera coleosperma*, Benth.), pod mahogany (*Azelia cuanzensis*, Welw.), the bloodwood, "Mvagazi" or "Mukwa" (*Pterocarpus erinaceus*, Poir.), *Albizzia* spp., *Burkea africana*, Hook, *Diplorrhynchus mossambicensis*, Benth., *Terminalia sericea*, Burch., *Combretum* spp., and many others. A large area of this forest, known to the natives as the "Mkulugusu," occurs to the north-east and comes down to within four or five miles of the Mzola and Shangani Rivers.

Between the high "gusu" and the rivers there is a low-lying flat area of varying width, consisting, according to the Geological Survey Department, of part of the Karroo system, *i.e.*, grits, sandstones, shales, etc. It is covered for the major part with almost pure mopane forest (*Copaifera mopane*, Kirk.), the soil being a whitish clay, very soft in the wet season. There are, however, considerable open spaces or vleis termed by the local natives "isidaga," which bear nothing but usually short grass. The name "isidaga," of course, means "mud," and sufficiently describes their condition in the rains. In the dry season they dry out, and the soil breaks up into innumerable fissures. The grass grows in separate tufts, and this, together with the cracking of the soil, renders these areas very uncomfortable to walk over. Many of them bear a low-growing thorn shrub barely as high as the grass. At their edges they may give way at once to pure mopane or to stream bank forest, but very frequently they are fringed by dense thickets of a thorny or thornless shrubby growth which is almost invariably quite leafless in the dry season. These thickets are known to the natives as "isinanga," which appears to be commonly used loosely to denote any dense growth difficult of penetration. As a general rule they consist of acacias and other *Leguminosae*.

It should be mentioned, however, that near the rivers are to be found open vleis which are not quite of the same type as those described above. The soil does not crack to the same extent in the dry season, and they bear tall grass six feet or more in height. They differ from many of the first type in that the grass grows away again at once after burning, whilst on the higher and more extensive type it does not, but awaits the rains. It is judged that in the one case there is a considerable depth of soil through which the roots of the grass penetrate, whereas in the surface-cracking type the soil is shallow and very badly drained, so that the grass is perforce shallow rooted and of poor substance generally.

Along the river banks, where alluvial soil is to be found, a different type of forest occurs. Here the large white thorn tree (*Acacia albida*, Del.) predominates, accompanied by the "Mudhlaoza" or "Mashuma" (*Diospyros mespiliformis*, Hochst.), *Ficus* sp., *Lonchocarpus capassa*,

* For these and other details of forest conditions in the area the writer is much indebted to Mr. J. S. Henkel, Forest Officer, who accompanied him on more than one visit to these regions.

Rolfe, *Kigelia pinnata*, D.C., *Trichilia emetica*, Vahl., and others. In some parts this forest is moderately open, especially after the grass has been burnt, in others it is full of tangled undergrowth and difficult of penetration.

It should be mentioned also that clusters of tall palms (*Hyphorcentricosa*, Kirk.) occur on the Shangani River above the Kana junction, at a pan some eight miles up the Kana River and elsewhere.

The species of trees constituting the stream bank forest are also to be found, usually much more scattered, along the edges of vleis and the banks of small water courses, which dry up altogether in the dry season. Also, along the Mzola River, particularly on the northern side, there is a strip of country some miles in width, in which vleis and mopane alternate with park-like country, where the trees of the stream bank species are thinly scattered or occur in small groups. Water is apparently not far from the surface along this stretch, as the grass grows away again promptly after burning, and the locality is then very attractive to grazing animals.

The rivers themselves are everywhere lined by thickets of sharp-leaved reeds (*Phragmites communis*, Trin.) of varying extent, in some places constituting a formidable barrier. Mingled with the reeds a species of *Rhus* is very prevalent, and in certain spots supplies close overhead shade of a moderately dense nature to the reed thickets. The willow (*Salix capensis*, Thunb.) is also found in this situation.

For a distance of two or three miles around the Gwaai-Shangani junction the formation consists of granite and gneiss, and here the country is rough and broken up into small hills. The forest is patchy, composed of samples of mopane with much "isinanga" and thick country. Small patches of gusu-like forest,* mostly of poor growth, also occur, and to the north of the Shangani this type predominates in rolling hilly country.

A notable feature of the area is the occurrence of salt pans or vleis. One of these, known to the natives as "Bushu," is situated within two miles of the Gwaai-Shangani junction, whilst another, known as "Ngondo," occurs near the Shangani, about thirty miles above the junction. To the north of this river (see map) there is also an extensive vlei which bears the name "Lubimbi," where a hot salt spring occurs, and numerous pools of strong brine. Natives visit these places to collect salt, and grazing animals for the purpose of licking the saline soil. The forest in the vicinity of these salt pans does not as a rule present any unusual features.

The occurrence may also be noted of a number of perennial springs, which are termed "shawu" by the natives. These are only to be found in or at the edge of the Kalahari sand formation, and are obviously due to water which has been absorbed by the porous sand gravitating out at the edges of the plateau, or in valleys in the gusu forest itself.

* The natives do not confine the name "gusu" to the forest growing on Kalahari sand, but apply it loosely to other forest of a similar nature.

At the point of exit there is usually an area of soil heavily impregnated with organic matter, which may be only a few square yards in extent or cover several acres. These commonly bear a heavy crop of reeds, and, of course, constitute attractive grazing spots shortly after the reeds have been burnt by the annual grass fires. Some of them are cultivated by the few natives resident in these parts.

Native Population.—This is very scanty, and very few natives are resident in country actually infested with tsetse fly. All the native kraals occurring in this area are shown in the map, and it may be mentioned that practically all the kraals consist of single families only. There are, of course, no European residents.

Fauna.—The fauna of the area includes the following:—

Mammalia—

- (1) *Primates*—Grey ape (*Cercopithecus pygerythrus*, Cuv.), baboon, *Galago* sp.
- (2) *Chiroptera* (bats)—Various species.
- (3) *Insectivora*—Various moles and shrews.
- (4) *Carnivora*—Lion, leopard, cheetah, lynx, wild cats, hyæna, wild dog, jackal, fennec fox (*Otocyon megalotis*, Desmarest), ratel, otter, miscellaneous *Mustelidæ* and *Viverridæ*.
- (5) *Rodents*—Porcupine, hare, spring hare, cane rat (*Thryonomis swinderemianus*, Temminck), grey-footed squirrel (*Panisciurus cepapi*, Smith) and numerous smaller forms.
- (6) *Ungulata*—Elephant (occasional visitor), rhinoceros, hippopotamus, warthog,* buffalo, zebra, eland, koodoo, roan, sable, waterbuck, tsessebe, blue wildebeest (very rare), gemsbuck (accidental visitor only), Lichtenstein's hartebeest (accidental visitor only), impala, reedbuck, bushbuck, duiker, steinbok, Gray's steinbok, klipspringer, rock rabbit (*Hyrax*).
- (7) *Edentata*—Ant-bear, scaly ant-eater.

Aves. The birds of the area are in the main those representative of the Territory generally. The ostrich is not uncommon, and several species of cranes and herons occur freely along the rivers, particularly the Shangani. The most conspicuous water-loving bird is the diver (*Phalacrocorax africanus*, Gmel.), which is to be seen along almost any stretch of either of the bigger rivers. Vultures, eagles and other birds of prey abound. The turkey buzzard or ground hornbill (*Bucorvus cafer*, Bocage) is not infrequent. The smaller hornbills (*Lophoceros leucomelas*, Shelley, and *L. epirhinus*, Holub and Pelz.) are exceedingly abundant, as also is the grey lory or go-away bird (*Schizoris concolor*, Layard). Game birds are represented by both the horned and the crowned guinea-fowls (the latter, however, being rare),

* It is noteworthy that not a single bush pig was shot during the operations.

francolins, partridges, and several species of wild duck and geese. The terrestrial game birds are mostly to be found in or near the river bank forest.

Reptiles.—Crocodiles are common in both the larger rivers, but are more frequently seen in the Shangani on account of the prevalence of sand banks. Other reptiles include the python, monitor lizards (*Varanus*) and the usual smaller snakes and other reptiles of the country.

Fish.—The prevalent species are the tiger fish, bream, mullet, several species of barbel and eels.

Operations against game are, of course, mainly connected with antelope and other hoofed animals, and it is, therefore, desirable to record something of their habits in this region. The writer was familiar with the area for some years before the operations commenced, and was, therefore, in a position to make notes on the habits and distribution of the game when the animals were practically unmolested, and on the subsequent change after they were subjected to intensive persecution.

As a general statement very little game was encountered in the "gusu" forest, unless carefully tracked by an experienced hunter. The most prevalent species in this type were sable and eland, and in a less degree roan and zebra also occurred. The mopane forest was the main haunt of impala, and these antelope were much addicted to the vicinity of the salt pans, as also were reedbuck, particularly at Lubimbi. Roan, tsessebe and zebra were frequently seen in the open "isidaga" country. Waterbuck occurred in great abundance near the rivers. Koodoo affected the vicinity of the river forest and thicker, often broken, country, where also the bushbuck was to be found. Reedbuck abounded in the long grass of the vleis near the rivers, particularly along the Kana, where this species occurred in remarkable numbers. Elephant were rare and occasional visitors, whose tracks were chiefly seen in the "gusu." Rhino were by no means uncommon, affecting the thickest "isinanga" and most secluded retreats. Hippo were migratory, and mostly passed along the rivers at night. Buffalo were very occasional visitors. Warthog were to be seen almost anywhere, and were particularly abundant. Duiker and Gray's steinbok showed no great preference for any type of country. Klipspringer, of course, were only met with amongst rocks. The common steinbok was mostly seen on open grassy patches after the grass had been burnt and commenced to grow again, chiefly in the vicinity of the "gusu" forest.

The movements of the larger antelope are, of course, to a large extent influenced by the seasons. They are more or less generally scattered throughout the veld during and shortly after the rains, when water and good grazing are widely distributed. With the drying up of the temporary water holes, the drying out of the grass and especially the burning of the latter they tend to concentrate on permanent water and strongly to seek the burnt vleis which show young green grass. Consequently in any well watered area such as that under

consideration the game tends to become more abundant as the dry season advances. It was the writer's experience before the operations, however, that game was abundant in the area whatever the season at which the visit was made. Visits were not made, however, during the height of the wet season, but included the months from the beginning of May to the beginning of December. In point of fact, the returns of the game shot during the operations indicate that in spite of the handicap of the long grass, frequent rains and lack of any clearly defined points of concentration for the game, considerable "bags" were made even during the wettest months. In September and October the number of buck to be met with was often remarkable, but even in May a walk of a mile in any direction near the rivers might practically be relied upon to reveal game at almost any time of day, and often large numbers.

This leads to a point on which it is desired to lay particular emphasis, namely, that previous to the operations those buck, which naturally preferred the lower type of country (and this includes all except eland and sable), remained in the vicinity of the rivers throughout the day and grazed freely in the open, if the weather was not too hot, from as early as two o'clock in the afternoon. They appeared to have no definite time for drinking, and were to be seen making their way down to the rivers or actually drinking at almost any time; in fact, a walk along the river banks at midday was as likely to reveal waterbuck, koodoo and impala, which were the commonest denizens of the area, as an excursion in any other direction. Even the "gusu"-haunting eland and sable had to pass through the lower ground to reach the water, and the latter were met with on more than one occasion moving in this direction about midday. The writer cannot recall having seen eland on the lower ground except towards sundown, when they were occasionally noted approaching the water, on one occasion almost immediately opposite the camp. They usually grazed for a time on any grass near the river before drinking.

It should be noted that, owing to the grazing near the Mzola River being excellent towards the end of the dry season, whilst surface water was lacking in that river within the area, large numbers of buck had a habit of trekking across from the Mzola to the Kana for the purpose of drinking. This they would do in single file, constituting an interesting spectacle, and the paths thus formed were quite conspicuous. After drinking they returned in the same way. They frequently reached the Kana towards sundown, but may have also come at other times. The adoption of single file was no doubt due to the unattractive nature of the country traversed, which consists of mopane forest and the poor type of "isidaga."

Tsetse Fly.—At the time of the writer's first visit to these parts in May, 1910, the whole area was found to be free from tsetse fly, the nearest specimens being taken in the "mkulugusu," ten miles north of the Mzola River, from a point about five miles above its junction with the Shangani. By 1913 "fly" was, however, established along a considerable stretch of the Mzola, commencing a few miles above the junction. By 1916 it was present in great numbers along a short

stretch of the Kana, just below the point at which that river leaves the "gusu" and winds into the low flat country. That year it was also found on the south bank of the Shangani, a few miles below the Mzola confluence. By 1919 the limits extended from close to the Gwaai-Shangani junction at the Bushu salt pan across to the Madwala (see map), and along the Shangani side of the "gusu" plateau to Ngondo salt pan and the Mhlegwa-Shangani junction, which was its approximate limit up the Shangani that year. North of the river the western limit was somewhere near the Sibone River, no fly having at that time been seen either to the west of this very considerable landmark near its junction with the Shangani, or north of it, where it runs in a westerly direction higher up; but it must be realised that the limits of a fly area are not to be regarded as exact within a mile or so, except where some natural feature imposes a check.

Throughout the infested area the fly was to be met with in patches of forest of most types, except gusu, as long as the mopane remained in leaf, but this tree loses its foliage about the end of July, and remains leafless until the next rains. This, possibly combined with other factors, brings about a concentration of the fly in the types of forest which remain shady, and particularly under the large trees bordering vleis and in the park-like country. The gusu forest is apparently not much favoured, for although fly certainly occurs throughout the "mkulugusu" to the north-east, it is interesting to note that during the four years of the operations fly was never located in this type of forest between the Shangani and Gwaai Rivers, notwithstanding the fact that with several changes in position of the main camp at least four different paths were opened up as the main communication with the railway. Along the edge of the gusu, where the latter gives way to mopane on gently sloping ground, however, the tsetse was commonly encountered in some numbers.

Amongst the spots where the fly was particularly abundant late in the dry season may be mentioned:—

- (1) Ngondo salt pan and along the edge of the gusu forest to Sebasinungu's kraal;
- (2) between No. 1 and No. 2 main camps at the edges of a series of vleis, particularly close to No. 1 main camp;
- (3) along the Kana River from near Bondo hill to the Palm pan;
- (4) along the Mzola River from a point about two miles above its confluence, and in the stream bank forest about the vleis and park-like country along the northern side;
- (5) around the Bira River and near Lubimbi salt vlei; *
- (6) on the Sibone River and along the north side of the Shangani to Lubimbi.

* Tsetse were seen in some numbers around Lubimbi in the dry season, but were at least as prevalent there in May and after the commencement of the rains, so that this cannot be regarded as a true dry season focus.

Elsewhere south of the Shangani tsetse occurred in small numbers late in the dry season near the river from Bushu salt pan upwards, along the edge of the gusu forest from Madwala to Sebasinungu, and at favoured spots on the numerous small water courses. A few specimens were also seen along the edge of the gusu on the north side of the Shangani from near Chiswino hill up that river to the Mhlegwa, the fly becoming thicker towards the latter river.

The Gwaai side of the area from the Gwaai-Shangani junction across to near the Madwala and along the edge of the gusu forest was free from tsetse as far as could be ascertained, although the flies undoubtedly occasionally followed parties, and probably game also, across as far as the Gwaai itself. A very careful inspection of a portion of this area was made and maintained from 1918 owing to the following circumstances:—

Along the left bank of the Gwaai River from Sianyanga's kraal at the Shangani confluence upwards many of the natives possess cattle, whilst Sikume farm (shown in the map) was occupied at that time by a European, who also had a considerable number which had been there for some years. In the early part of 1918 an outbreak of trypanosomiasis occurred on this farm, occasioning serious loss. Only one herd was affected that season. Endeavours were, therefore, made to locate tsetse fly in the vicinity without success. The following season not only did further severe losses occur at Sikume farm, but native cattle for about 12 miles up the river were also affected. Further efforts were then made to locate tsetse on the Gwaai side of the watershed, including the employment of four natives for several weeks, but the result was negative. In the 1919-20 season not only were all the original herds again affected, but also many cattle at Dingaan's and neighbouring kraals near the Dett River, and the next season Sianyanga's few cattle began to die of the disease, and an outbreak occurred far up the Gwaai some 35 miles above Sikume farm. Sikume farm was vacated by its original tenant in 1920, but was occupied a few months later by another European with cattle, which appear to have remained healthy until the present time. It is curious to note that Sikume farm, where the first outbreak occurred, is in reality the furthest removed from known tsetse fly country of any spot on the affected portion of the Gwaai River, and that the nearest cattle to known "fly," namely Sianyanga's, were amongst the last to become infected. This fact, of course, led to the most detailed search being made in country which proved to be free from "fly," and the country near the Gwaai-Shangani junction was not so thoroughly inspected, as it would otherwise have been, until 1919. The writer, however, traversed it several times in 1918 without seeing any tsetse west of Walker's Road, but the country is broken and difficult of thorough inspection. Fly was first located at Bushu salt pan in 1919 by one of the European hunters.

Whilst the original cause of the outbreaks of trypanosomiasis amongst cattle on the left bank of the Gwaai remains unknown, there is little doubt that the main losses were due to transmission of the disease by some other factor than tsetse fly. The inception of the out-

breaks was probably due to "fly" following parties of natives, and perhaps game, across from the infested area. Observations made after 1918 showed that flies would follow across the watershed as far as the Gwaai River in cool weather.

Now, for the recording of positive results from the experiment, it was realised from the first that *broad effects* would be necessary, that is to say, the tsetse would need to disappear from certain parts, or at least be reduced from abundance to comparative scarcity. It was, therefore, considered unnecessary that an elaborate and prolonged calculation of the density of the fly at various points should precede the commencement of the operations. A reduction of 25 per cent., or even 50 per cent., in the density of the fly at all the points selected would, it was thought, be of little significance, particularly as methods for estimating this density do not give by any means exact results. Unless a very obvious effect was to be observed in the fly haunts, the result of the experiment would perforce be regarded as negative. None the less, it was thought desirable to record certain rough figures as a basis for comparison, and in October, 1918, the writer made an effort in this direction. Unfortunately the observations were cut short by the influenza epidemic, which attacked his carriers and necessitated a hurried return to the railway. Observations of this nature were, however, recorded each year in October during the operations, and the figures will be given in due course when considering the results of the experiment. For the purpose of making these observations the same country was, as far as possible, examined each year. In some cases the number of flies caught in traversing a definite line was thought the most suitable method, in others all the flies seen were caught at a selected spot for a definite time, and in one case the number of flies, which apparently exhausted the spot for the time being, was made the basis of the comparison.

With respect to the selection of October for the annual inspection, it may be stated that owing to various circumstances the first detailed observations could only be conducted in that month, and that it is absolutely necessary, for the purpose of comparison, that the visits should be made at the same time each year. October has, in point of fact, a great advantage, in that the fly at the end of the dry season is concentrated to the maximum extent. Its disadvantages lie in the intense heat and the fact that local thunder showers are liable to occur, for there is reason to believe that a sharp shower has a marked effect in diminishing for a time the tendency of the fly to come to human beings. Fortunately rain did not seriously interfere with the observations during the experiment. The area was, of course, visited at other times than October, and the distribution and prevalence of the fly were found to be very much affected by the time of year. In July, for instance, tsetse could not be found at all at some of the spots where it congregated later, as for instance at the Mzola indices (see map). It is instructive to read in the reports of the officers in charge great optimism concerning the almost complete eradication of the fly during the winter months, followed by reports of re-appearance at various spots later in the year. It is not the writer's intention to state that

tsetse fly is necessarily scarce in the winter months, although it certainly appeared to be in the area of operations, but that the distribution is different, and therefore parallel comparisons cannot be made between the density of fly at any given spot except at the same time of year.

The staff employed in the operations consisted, during the greater part of the time, of an officer-in-charge, three European hunters and nominally twenty native hunters, whose actual number, however, rarely exceeded fifteen, and sometimes fell as low as twelve. Efficient native hunters are apparently not as plentiful as many people suppose. In addition fifty carriers were employed. The officer-in-charge made his headquarters at the main camp, and until the last year kept one of the Europeans with him. The remaining Europeans were stationed at separate camps with one or more native hunters according to the quantity of game in the locality, and the necessary number of carriers. The remaining camps were occupied by one or two native hunters, each with one carrier. A record was kept of all the game shot, the native hunters being required to produce the skins in support of their reports in this connection. During the first year the game bagged was, as far as possible, utilised for making reims and biltong, but for various reasons, principally the slump in the market value of these articles, the practice was afterwards discontinued, and the hides were disposed of in bulk.

Game and other Animals Destroyed.—A full list of the animals actually "bagged" is given in the attached table, which is arranged so as to show at a glance the number of each species, the number of each class and the total "bag" for any month or year or during the whole of the operations.

These figures call for careful examination. It should first of all be noted that the operations in the first year, 1919, lasted only from about the middle of June to 6th November, and included, therefore, only four complete months, *i.e.*, July, August, September and October. In 1920 the work was continued from 24th March until the end of the year, in 1921 from the commencement of the year to 15th December, and in 1922 from 15th June to 15th November only. On this account the totals for any two years except 1919 and 1922 are not comparable. Furthermore, the composition of the "bag" will be found to vary considerably with different years. For instance, in the first two years comparatively little attention was paid to small buck, only 74 being secured in 1919, whereas a similar period in 1922 yielded 306. In the following table the total "bags" in each class for the four months which are common to the four years are compared:—

JULY TO OCTOBER (INCLUSIVE).

1919.		1920.		1921.		1922.	
No. killed.		No. killed.	Compared with 1919.	No. killed.	Compared with 1920.	No. killed.	Compared with 1921.
			Per cent.		Per cent.		Per cent.
Large pachyderms...	9	15	+ 66	1	- 93	3	+ 200
Warthog ...	122	62	- 49	53	- 14	157	+ 196
Large buck ...	859	421	- 51	290	- 31	709	+ 144
Small buck ...	62	76	+ 22	169	+ 124	259	+ 53
Large carnivora ...	9	3	- 66	3	...	5	+ 66
Miscellaneous ...	21	16	- 24	46	+ 187	22	- 52
Totals ...	1,082	563	- 45	563	- 5	1,155	+ 105
							+ 7

Probably the first point which will occur to the reader in connection with the above table is that whilst there was a great falling off in the number of animals which can be classed as "big game" killed up to 1921, a big increase occurred in 1922. Two main causes probably contributed to this, namely, (1) the unprecedented general drought of the preceding summer, which everywhere drove the game to concentrate to an unusual extent near water during the ensuing dry season, and (2) disturbance of the game by hunters further up the Shangani. With respect to (2), it was found that shortly after the commencement of the operations in 1919 buck migrated in considerable numbers up the Shangani, so that those regions became unusually well stocked with game, even as far as the Shangani reserve. In the hope of checking the continued spread of fly towards this reserve, however, certain areas were granted for hunting purposes to various individuals in 1921, and the natives were encouraged to hunt within the borders of the reserve, a privilege of which, on account of the general famine, they presumably availed themselves to a considerable extent. The fact that the area had been left undisturbed for the previous six months no doubt also had a great influence in the re-invasion of the area. The great increase in the numbers of warthog and small buck shot is, however, surprising, and suggests that these animals probably move about the country more than is generally supposed.

It is now necessary to consider to what extent the number of animals shot may be relied upon as an indication of the actual numbers present within the limits of the area. At the commencement of the operations it was found that although most of the native hunters, who were practically all ex-soldiers, were moderate target shots, they were singularly unsuccessful in the pursuit of game. With experience, however, they gained efficiency, and some of them eventually were not far inferior to the European hunters. Owing to their earlier efforts, however, the game was rendered wilder and more difficult of approach. Had they started with the same efficiency as they acquired later, the bag must have been very much increased. In point of fact, the few Europeans accounted for the bulk of the game shot in July and August, 1919. Furthermore, the native has a peculiar disinclination for hunting after he has killed, and, in addition, during the first year the hunters were required to bring the whole of the buck into camp. Consequently one buck killed naturally occupied the hunter and his carrier for the rest of the day, and under such circumstances the day's bag remained the same whether the kill occurred close to camp or five or six miles away. Moreover, the report of the rifle naturally stampeded all the buck in the vicinity, so that even if the shot was successful, the "bag" bore but a small proportion to the number of buck within earshot before the discharge.

From the foregoing considerations it is judged that the density of game during the first year of the experiment is greatly under-indicated by the number of animals bagged.

Furthermore, as game grew scarce in the succeeding years, the hunters naturally followed it further afield, and it is beyond doubt that many head were shot outside the limits of the area. A particular

temptation for the hunters in this connection was the neighbourhood of the "pan," where permanent water occurs, up the Mzola River. This spot is a great game centre, and as, unfortunately, the hunters were apt to be more concerned in making a big "bag" than in patrolling their lawful areas, considerable numbers were killed in this region, especially in 1921 and 1922. It is, in point of fact, hardly in human nature to continue patrolling a region where game is scarce and wild, when by taking one's blankets and food and walking ten miles or so game can be met with in abundance. It must be borne in mind that on the north-eastern and eastern sides the area adjoined country where game in many parts is extremely abundant and practically unmolested in the ordinary way.

The maintenance of the "bag" was also contributed to by several so-called "Bushmen," known locally as *Amusili*, joining the staff as hunters. These natives are as a rule much better trackers than the Matabele or Batonka, and they followed the game with success far afield into the "gusu" forest, where the animals tended to take refuge during the day as the persecution on the lower ground grew more intense.

This brings us to what, in the writer's opinion, is a considerably more important point than the actual number of animals within the area, namely, the marked change in habit which was, and probably is always, the natural outcome of persecution. The unsuspicious habit of remaining near the rivers during the day, which has already been recorded, was gradually discarded by the buck. Those which did not desert the area altogether began to make a practice of retiring towards the gusu during the day, and whereas a walk near the rivers before the operations always revealed numbers of buck of different sorts, several days' walking in the same regions might not reveal a single animal later. Tracks, however, showed that the animals came down to graze and drink at night. From this statement we must, of course, except small buck, including bushbuck, which merely became much more wary. The bushbuck were, however, largely dealt with by driving their haunts and using shotguns. The impala did not go as far afield as the larger buck, and were probably of considerable importance in feeding the fly near the salt pans. They became extraordinarily wary, however, and baffled the hunters to a great extent. The number of these animals "bagged" remained fairly uniform through the operations.

As a general statement, therefore, it may be said that the larger buck to a great extent deserted the low ground, and consequently the haunts of the fly, during the daytime, and contracted the habit of visiting it at night for the purpose of grazing and drinking. As the tsetse fly is only active as a rule during the daytime, this habit must naturally have tended to deprive the fly of its customary plentiful opportunities of obtaining a feed at the expense of the buck.

On account of the foregoing considerations it is obvious that the monthly "bag" has comparatively little direct relation to the number of animals present in the fly-infested country during the daytime

when the insect feeds. In point of fact the "bag" is not a correct indication of the number of animals present in the area as a whole, although it is, of course, obvious that a considerable number were present during the last year of the operations.

Now, it is to be noted that the country south of the Shangani, between that river and the "gusu" from Walker's Road upwards, consists mainly of open mopane and "isidaga," with narrow strips of river forest and vleis. It is also easily accessible from the main camps. In this portion of the area the formerly abundant game was soon reduced to a minimum, and this minimum was effectively maintained throughout the operations. Up the Kana River and north of the Shangani above this river the country is also of an open nature except for some patches of "isinanga," which on account of their limited extent served rather as a convenient screen for stalking game than as any great protection to the animals. North of the Shangani and Mzola, however, the country is not so uniformly open and accessible, considerable areas of isinanga occurring near the Bira River and Lubimbi, whilst lack of fresh water renders these areas much less accessible, for although they are within walking distance of the rivers, it is not possible to form permanent camps close to the game haunts. The reduction of game in these areas which about on the game-haunted country to the north-east was, therefore, far less satisfactorily effected than elsewhere. The "isinanga" especially hid rhino, koodoo and warthog, and, in view of the fact that the hunters were as a rule disinclined to remain five or six miles from the camp till night-fall or to get up early enough to reach these spots at day-break, the game naturally had much better opportunities of feeding early in the morning and in the evening than, for instance, in the well-trodden area south of the Shangani.

(To be continued.)

Poultry Husbandry.

ARTIFICIAL INCUBATION, BROODING AND REARING OF CHICKENS.

By H. G. WHEELDON, Assistant Poultry Expert.

Anyone who contemplates starting poultry keeping is confronted with the problem of "breeding." The pivot point, on which the success of a poultry man turns, is his ability to reproduce stock. The profitable period of a fowl's life is so short in duration that it is necessary to raise stock for the laying pens every year, and the beginner finds this to be the hardest part of the whole business, the success of which is most important. Success is attained only by the intelligent application of correct methods. If the incubation, growth and development of the chicks are not accompanied by such conditions as produce and maintain the good health necessary for building up a vigorous bird with strong constitutional qualities, the mature bird does not have the power to produce or earn more than a nominal profit for its owner. However well it may be housed and cared for, the effect of any adversity during the chick's life does not stop at the profit of the first year. The progeny of such birds is not only weak and unremunerative, but if raised under like conditions, will be less valuable than the parents, and such rapid deterioration will render the flock absolutely unprofitable in two or three generations. On the other hand, chicks well hatched from good eggs, if given intelligent care and surrounded with the essentials required for proper growth and robust development, will mature into fowls which are capable of returning to their owner the last farthing in payment for the food and accommodation provided. Good methods, well grown and matured stock, increase the productive efficiency of succeeding generations, and the road to successful poultry keeping is immediately opened.

The chick hatched for the market must make a very rapid growth; not so much of bone and muscle as of flesh and fat. To do this in the shortest time assures the greatest profit, and the conditions and methods of rearing in many cases must be largely artificial. The chick destined for the laying house, however, must be allowed to grow steadily without a set-back, and natural conditions must be approximated as closely as

possible with a view to developing bone and muscle with a vigorous constitution; the young birds will then stand the conditions of heavy egg yielding which are necessary to produce the results that count.

In building up a strain of fowls there is something even more important than breeding for standard points and prolific egg production, and that is breeding for health and constitutional qualities. How many poultry men do this? Comparatively few; those who are successful in the business on a large scale, have learned by experience that it pays to breed for vigour and vitality. The natural method of breeding is the "survival of the fittest," and we need to take some of this "back to nature" doctrine into the poultry yard and to begin now to breed for inside values, not alone in this season's chicks, but season after season for all future generations of chicks. Every breeder knows that inside values count in breeding, and if not inherent they cannot be depended upon to come out in the chick, as inherited faults or weaknesses are often faithfully transmitted to the offspring for several generations with the tendency to increase rather than to lessen.

Select every bird intended for the breeding pen, first for health and vigour, and then for desired qualities in other desired respects. Choose only the best to breed from, even if a few birds only are used, and so mate them that similar physical defects will not be found in both males and females, and thereby try to offset defects in one parent by breeding to it a bird that is strong where the other shows weakness. When the choice is made and the fowls well mated, then house, manage and feed them sensibly with a view to producing maximum health and vigour. The needs of the fowls are of the simplest: a comfortable shelter when needed, a fair variety of wholesome food, pure water to drink and an abundance of fresh air to breathe at all times without draughts, are important essentials. When in doubt study the fowl; often the natural instinct given to it for self-preservation will be a good guide to follow, and to one whose heart is in the work, it is as interesting as it is important, and offers opportunity for the full exercise of both the mental and physical powers.

It is not sufficient to exercise reasonable care with the breeding stock alone; the care and the management of the eggs between laying and hatching, during the hatch and of the chicks to maturity or breeding and laying age are of equal importance. It is upon the common sense application of these truths that the success of poultry culture in the future depends, as year after year complaints are heard of lowered vitality in the flocks, the greater difficulty in obtaining a good percentage of fertile eggs, of poor hatches, dead in shell, and of chicks that, though a fair percentage hatched, did not thrive. Is it not fair to assume that the lack of power to live and reproduce is due almost wholly to impaired constitution, to breeding, housing, hatching, rearing and feeding without due consideration to reproducing inside values in health and vigour?

Assuming then that the breeding birds have been well selected and mated, well housed, and supplied with their natural requirements such

as grit, lime or oyster shell, animal food, pure water, and abundance of green food daily, and fed on sound wholesome foods, and provided with ample litter in which to exercise, the next point of importance is the proper care of the eggs for incubation, and this is where many poultry keepers unconsciously go wrong. Careless methods of handling and keeping eggs impair the fertility, and hatching power in many cases may be entirely lost by wrong methods of handling eggs for incubation. Probably more chicks are found dead in the shell or die soon after hatching every year from this cause than from any other.

Eggs intended for the incubator should be gathered once daily in the cool weather, and twice daily during the very hot weather. Renew nesting material often, handle the eggs with clean hands, place them in a clean receptacle and keep them in a rack with small end downward to establish the air space in the proper place and prevent evaporation of the contents through draughts of air, and keep them in a cool fresh room where the temperature does not go below 40 or above 60 degs. F. Whenever possible they should be used for incubation before they are a week old. Prolonged exposure of the eggs to a temperature of 70 to 80 degrees, or frequent warming and cooling while keeping for hatching, may kill the germ or will surely result in a weak chick. Select only the best and uniform eggs for hatching.

Faulty incubation is accountable for much loss. This may apply to both the natural and artificial systems, although more frequently the latter is at fault. This is because so many things that will injure the chick may happen with good machines in the hands of poor operators, or poor machines in the hands of good operators. It should be mentioned, however, in justice to the most modern systems of incubation, that the best results have been obtained when artificial incubation has been practised for many years. There are certain types and makes of incubators, such as moisture machines and hot air machines, each of which has different essentials that are important to successful hatching of the eggs, and it is advisable to thoroughly understand and follow the printed instructions accompanying each machine. In choosing an incubator be sure to get a machine of sufficient capacity to meet your requirements. It is much better to be obliged to set 50 eggs in a 100 egg machine than to have 100 eggs you want to hatch and only a 50 egg machine to put them in.

The most important things to consider in selecting the locality for a machine are freedom from excessive vibration, air free from foul odours, and a solid level floor or platform on which to set the machine. It is very important that the incubator be level, otherwise the egg chamber will not heat evenly. Ventilation of the room may be secured and controlled by dropping the windows at the top and raising them at the bottom, preventing a draught in severe or rough weather by inserting hessian covered frames in the open spaces. By having these frames in two or three sizes and one or more windows the situation may be thoroughly mastered. After studying the instructions carefully and setting the machine in a well ventilated place, but not in a draught, run it empty for a few days until you become thoroughly familiar with

every detail, and have the regulating device properly adjusted so as to maintain an even temperature of $102\frac{1}{2}$ to 103 degrees in the egg chamber. One should be careful about the thermometer being correct before placing the eggs in the machine. It is necessary to fumigate the egg chamber with formalin before the eggs are placed in the machine and after each hatch. After the operation of the machine is thoroughly understood and the desired temperature maintained in the empty incubator, the eggs may be put in and left for several hours to warm up, being careful that the temperature does not run above 103 degrees. After 24 hours the eggs should be turned twice and aired once daily. These turnings should be as nearly twelve hours apart as possible. There are no infallible rules for the running of an incubator. The amount of moisture and ventilation required, the manner of turning and cooling the egg, and the many details of the operation cannot be indicated in a definite manner for every machine, and are subject to variation according to the make, the system of the machine and the external conditions under which the machine is being worked. The usual way of turning eggs is to remove them from the centre of each row in the tray to the ends of the rows, and with the hand gently roll the balance inwards towards the centre of the tray. This method may be adopted for the morning turning and cooling, and in the evening give each egg a quarter or half a turn, and then close the drawer without cooling the eggs. As to the length of time for cooling the eggs, no hard and fast rule can be given, and this must be left to the discretion of the operator. In very hot weather, however, when the temperature of the incubator and the room runs high, the eggs may be cooled from five to fifteen minutes longer than under ordinary conditions, remembering always that during the last week of incubation the eggs also require more air than they do during the first ten days. Under ordinary conditions the eggs are aired and cooled during the early stages of incubation sufficiently to give best results while they are being turned. A point of great importance is to turn the flame of the lamp very low during the time the eggs are being cooled. The embryo chicks generate animal heat as soon as they commence to make growth, and the volume of heat increases steadily towards the latter part of the hatch. This is the reason why the temperature in the drawer usually rises during the last week or ten days, and it may be necessary to very carefully readjust the regulator during this period, which must be done if the temperature runs above 105 deg. F.

Eggs should be tested twice during the hatch, the first test being made on the seventh day, and the second on the fourteenth day. At the first test remove from the drawers or trays all unfertile eggs, broken yolks and dead germs. Mark those which are doubtful, and let them remain in the machine until the second test; if they do not develop before that time they should be removed, as well as all other dead and weak germs and addled eggs. Stop turning the eggs on the morning of the twentieth day, or sooner if the chicks begin to break the shell, and push the drawers or trays well back as far as they will go; in some machines a space is provided for the chicks to fall through into a nursery below, which should be opened. Close the machine and

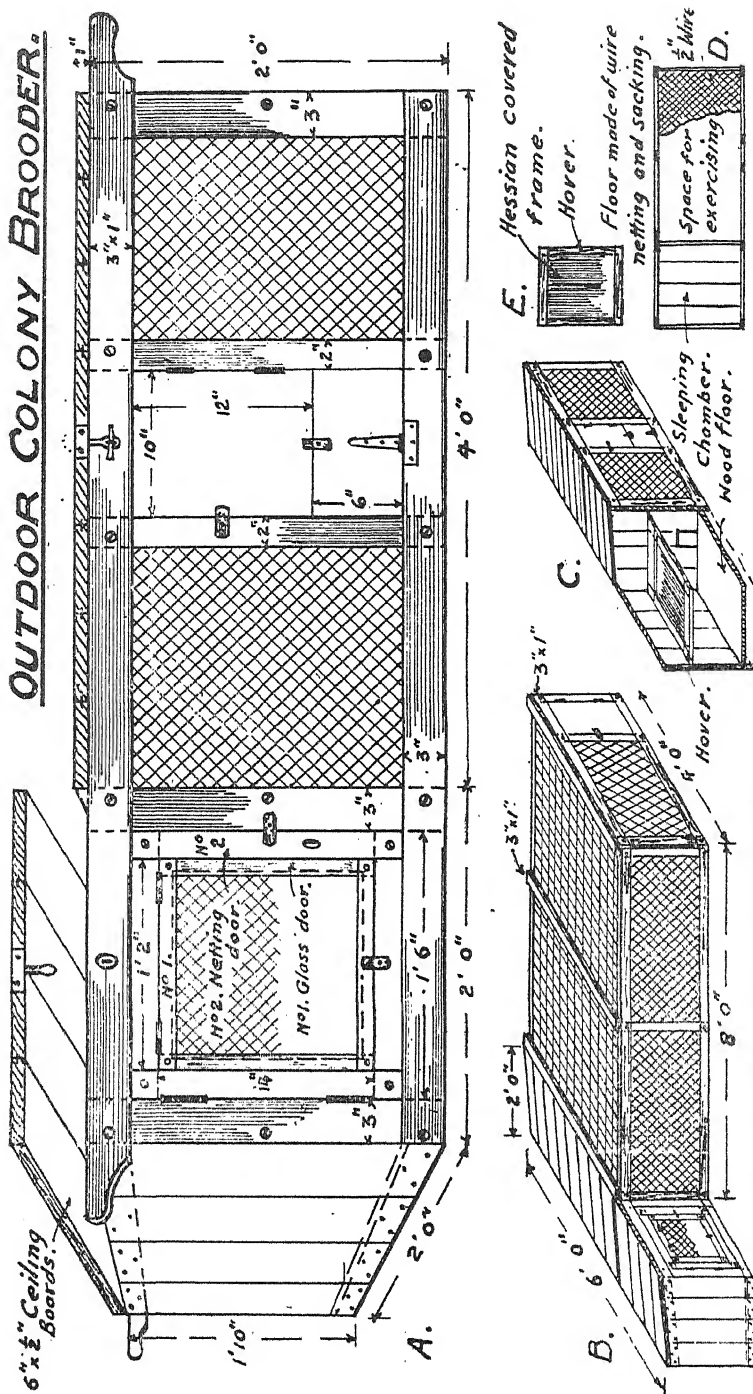
leave it alone until the hatch is over, or until the morning of the twenty-first day, when the empty shells may be gently removed. If the machine has been properly regulated it is perfectly safe to leave it, and it will do no harm if the temperature runs to $104\frac{1}{2}$ or 105 degrees when the chicks are hatching, but it should not go higher. Allow the chicks to remain in the drying box of the machine for twenty-four to thirty-six hours after hatching, then remove them to the brooder, which should have been previously well cleaned and littered, and which should be placed with the chicks in a sheltered sunny locality. Keep them exposed to the sun as much as possible, taking care to provide shade for use when they require it. At this stage and until a few days old the chicks must be carefully attended to, and a point of great importance is not to allow them to become "chilled." Be guided by the "chirp" of the chicks, which tells plainer than words whether they are thrifty or uncomfortable, and should be taken notice of immediately, as the usual requirement is warmth.

Artificial brooding is a comparatively easy matter to follow. When natural brooding is employed more than half one's anxiety is removed, and when the work is to be conducted on a small scale this method will answer, but where large numbers are to be hatched and grown any but the artificial system would be too laborious and out of the question. This being fully understood, the only change to be considered is artificial brooding, either in a brooder house or in the form of out-door brooders. For the poultry keeper who occupies a permanent place, and has had ample experience, and is financially "easy," it is a simple matter to instal a long suitable brooder house with the necessary conveniences. But the man who has arrived at this stage of his chicken raising does not need very much advice, and is likely to accept less.

The trouble with most brooding systems is the cost, and poultry keepers who are out to save expense and are running their poultry to make money are always keenly alive to the possibility of saving money and time. The need of finding a cheap and efficient means of mothering the hundreds of chicks to be raised this season has become a matter of great importance, and for the economical brooding of chicks, therefore, the use of out-door colony brooders is advocated, since they are easy to make, vermin-proof, and can be moved about and placed on fresh soil as frequently as may be required. During the off-season they may be used for penning breeding cocks and cockerels. The accompanying diagram (No. 1) is a design of a suitable out-door colony brooder.

- A. Brooder showing lid in two sections.
- B. Brooder with detachable run attached.
- C. Brooder with front and side of brooding chamber removed showing boarded floor, partition and entrance to exercising quarters.
- D. Indicates floor of exercising quarters, which is made of hessian and wire netting.
- E. Hessian-covered hover to fit in the brood chamber.

OUTDOOR COLONY BROODER.



Brooder with run attached.

*Irrigation Office,
Salisbury. 15.3.23*

Diagram No. 1.

The brooder should be ready, *i.e.*, thoroughly fresh and cleaned, and the floor littered with finely cut straw or grass. For the first two or three days the chicks should be confined to the hover section, allowing the sun to shine through the wire and glass doors all day; on the third or fourth day they may be given the opportunity of using the exercising apartment of the brooder, and later allowed in the attached wire run. During the first two or three days the hover must be lifted frequently, and placed over them again after feeding and before they have an opportunity of becoming chilled. By frequent handling in this manner they will soon learn what is required of them, and may soon be trusted to take care of themselves when in need of warmth. If they show any disposition to crowd or huddle together at any time, drive them under the hover to warm up. After they are a week or ten days old they may be provided with and allowed access to the wire run. A good shelter for shade is a desirable addition to the brooder run. Not more than fifty chicks should be placed in one flock in any brooder, as this is considered the maximum limit of safety. Care must be taken to keep the chicks warm and comfortable at all times, and to see that they are always supplied with an abundance of pure fresh air. The chicks should be given an opportunity to exercise in quarters that are not too cramped or crowded, remembering always that overcrowding does more harm than improper feeding, especially if overcrowded under the hovers at night. Sun and air the hovers daily, as well as the litter; the latter should be forked up and cleaned and aired, and renewed as often as may be required.

It is management from first to last that counts more than what particular food is used. The successful feeding of chicks is not a difficult problem; almost any sweet, clean, dry food given regularly is all they require in the way of food, with fresh clean water, fine sharp grit, and bone meal always kept in front of them. When the chicks are from twenty-four to thirty-six hours old they will be ready for their first feed, which should be given preferably after they have been removed to the brooder, when they should be provided with a shallow vessel containing water and a little grit. Two or three pieces of stick or straw may be allowed to float on the surface, which the chicks will peck at and soon learn to drink. Provide also a shallow tray into which a little dry bran or oatmeal should be placed. At frequent intervals during the first two days their attention should be drawn to the food, either by tapping the food with the forefinger or by taking a pinch of the food between the thumb and finger and allowing it to sift down from a few inches above the food tray, at the same time imitating the cluck of a hen. By these simple means chicks can be taught to eat, and will soon learn to care for themselves. From the third day a little munga or commercial chick food or bread crumbs soaked in milk and squeezed dry may be given in conjunction with the dry bran and fed at frequent and regular intervals.

Growing birds want variety if for no other reason than to maintain their appetites, and there must be no stinting during their chicken stage. The bran, to which a little charcoal is mixed, may be kept before them all the time in a food box or small hopper covered over

FEEDING HOPPER FOR LARGE BIRDS.

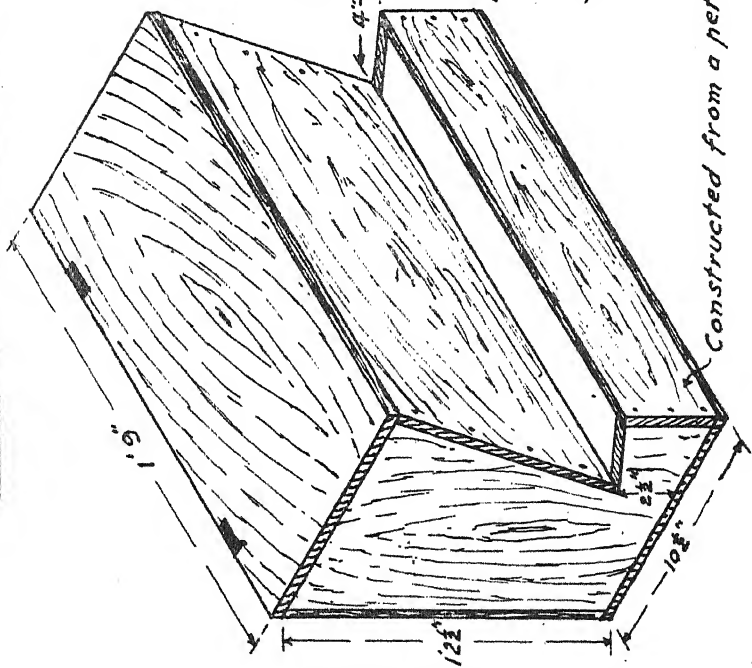
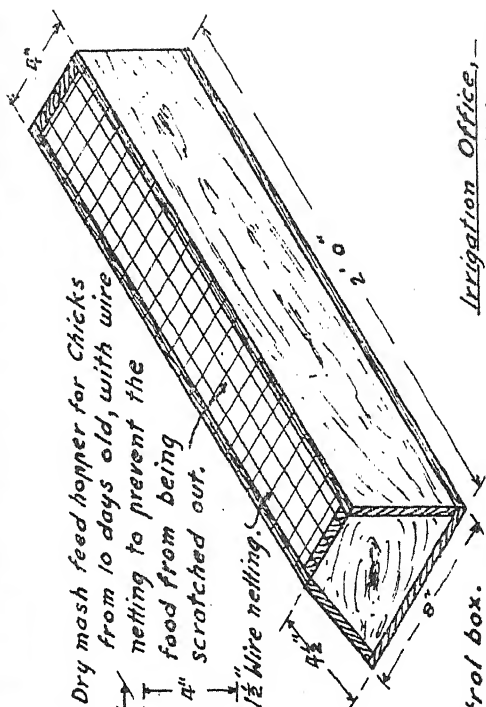


Diagram No. 2.

FEEDING HOPPER FOR CHICKS.



Constructed from a petrol box.

Irrigation Office, -
Salisbury, 16.3.23.

by small mesh wire to prevent them from scratching and wasting the food. Grit and water are also necessary at all times, as well as finely cut tender green vegetation. At the end of the first week or ten days a little clean meat-meal or blood-meal may be added to the mash as well as bone-meal, which is necessary for all ages of growing chicks, and the same may be said about milk. As the chicks grow older gradually accustom them to a larger range or run, and place this on grass land if possible. At the end of the first week or ten days begin substituting a good commercial chick grain mixture for the oatmeal, and throw it in some loose litter, which will cause the chicks to get good exercise in scratching for it. Do this at least four times a day, giving the grain mixture often, and feed but a little at a time is the rule for feeding young chicks. When the chicks are three weeks old give them a mixture of larger grain such as cracked wheat, crushed mealies, munga and linseed. By the time the chicks are six to eight weeks old the principal dangers of chickenhood are past, and at this age they may be removed from the brooders to suitable coops.

The chickens intended for breeding stock or layers should be allowed to run out in the fields, where they can have free range, but they must also be given a liberal supply of nourishing food to build up strong healthy vigorous birds. Reasonable precautions should be taken to ensure steady continuous growth. Guard against insect vermin, and keep the coops clean and dry. Chickens intended to be kept for laying or breeding purposes should be carefully selected when quite young, the first selection being made to the best advantage when they are eight weeks old. Select all the cockerels and pen them apart from the others. Those which have been kept back by ailments or through any other causes should be separated from the more robust ones and placed in a separate pen. Self-feeding hoppers are of the greatest advantage in feeding poultry of all ages. In using hoppers for the dry mash time and labour will be saved. This method of feeding is the cleanest, easiest and best way to feed poultry. They may be filled every second or third day or once a week, according to the size of the flock which is being fed from the hoppers, which may be left open all day and the chickens allowed to help themselves. In addition to a dry mash they must be supplied with a grain mixture. At the age of three or four months they may be fed on the same grain mixture as the laying hens.

There are many grains and meals obtainable in Rhodesia which are suitable for feeding poultry, and a good combination may be made up to suit the poultry keeper from the kinds of grains at his disposal. The accompanying menus have proved satisfactory, and will serve as a guide for general use:—

First week to ten days.

Grain mixture.

Dry mash.

- | | |
|--|---|
| 1. Pinhead oatmeal, or | Wheat bran, 2 parts |
| Commercial chick food No. 1, or | Pollard, 1 part |
| Munga. | Powdered charcoal, $\frac{1}{2}$ oz. to 1 lb. of mixture. |
| Fine grit, separated milk curd, clean water. | |

*After ten days.**Grain mixture.*

2. Commercial chick food No. 1, or
Oatmeal, or
Munga.

Dry mash.

Wheat bran, 2 parts
Pollard, 2 parts
Mealie meal, 1 part
Animal food, $\frac{1}{2}$ part
Charcoal.

Grit, milk curd, green food, bone-meal, clean water.

*Four weeks to three months.**Grain mixture.*

3. Crushed mealies (fine), 2 parts
Munga, manna or millet, 1
part
Crushed pea nut, 2 parts
Wheat or buckwheat, 2 parts
Linseed or sunflower seed, 1
part, or
Commercial chick food No. 2.

Dry mash.

Wheat bran, 2 parts
Pollard or pea nut meal, 2 parts
Mealie meal, 2 parts
Animal food, 1 part
Lucerne or sunflower leaf meal,
1 part
Charcoal.

Grit, bone-meal, clean water, etc.

*For growing pullets and laying hens.**Grain mixture.*

4. (a) Crushed mealies, 3 parts
Crushed pea nut, 2 parts
Sunflower seed, 1 part
(b) Crushed mealies, 3 parts
Sunflower seed, 1 part

Dry mash.

Wheat bran, 2 parts
Pea nut meal, 2 parts
Mealie meal, 2 parts
Lucerne or sunflower leaf meal,
2 parts
Animal food, 1 part.

Grit, oyster shell, clean water, etc.

Farming Calendar.

April.

BEE-KEEPING.

Where numbers of the bee-louse are seen attaching themselves to the legs of bees and also among the quilts which cover the frames, this pest can be controlled by crushing them with the finger. In the cooler districts, crates that are partially filled with honey should be removed, and into the lift which they occupied plenty of warm clothing should be snugly packed.

CITRUS FRUITS.

During the early part of this month autumn budding can still be performed if sap is still up; in fact, if the season is late this operation is better done a little late than early, as in the event of late rains occurring, followed by a warm spell, the buds are liable to start growing, but are soon checked, the result of which is usually a stunted tree. Water by irrigation should be supplied to bearing orchards, unless unusual soaking rains have fallen late in season, followed by thorough cultivation and hoeing around trees. Continual watch must still be maintained for fruit-eating and codling moths. Spraying or fumigating against insect or other pests should not be neglected. Some early varieties may be expected to be ripening towards the end of this month.

CROPS.

The rains are practically over by this month, and the harvesting of early crops, such as buckwheat, linseed, teff grass and manna, will commence. The silo pit should be got ready, and the making of ensilage should be undertaken during this month. The cutting of veld hay for feeding should be completed by the end of the month. The mower, however, should be kept going, and the later cuttings should be utilised for litter in the kraals. All lands that are available should be ploughed. The preparation of vleis for winter crops should be continued, and late varieties such as Algerian oats should be sown this month; also barley for an early green crop.

DAIRYING.

The milking kraal at this season of the year is generally far from clean, on account of the rain. By cows getting covered in mud from the kraal, and subsequently being rubbed off during the process of milking, the milk becomes highly contaminated with numerous species of bacteria. These bacteria, or germs, are the cause of nearly all the trouble in butter and cheese making which arises at this period of the year, i.e., during the wet season. To prevent the same, cows should be milked in a dry place, free from dust. If the udders are found to be dirty just previous to milking, then the milker should clean the affected parts, as the udder, flanks, etc., with a cloth which has been wrung out in clean cold water—the udder should not be washed. The milker's hands should also be washed after each cow is milked. This all spells labour to certain people, but means all the difference between the production of first grade cream and third grade, or a saleable cheese and a non-saleable cheese. In the cheese-curing room, dampness is often prevalent during the wet season.

with the result that the cheeses are often covered with green and white mould. This cannot altogether be prevented unless a properly constructed room is available, therefore wipe each cheese with a cloth every day, and the shelves should be scrubbed once a week with hot water to which a handful of washing soda has been added, and when dry should again be washed with water to which has been added a few crystals of permanganate of potash. The cheeses may also be wiped with a cloth dipped in the same water. Although the mould is rather unsightly, it has no great significance, because it readily comes off when the bandage is removed, and, if the cheese is properly made and properly pressed, does not penetrate. When evening's milk is used for cheese-making great care should be taken to cool it and keep it in a cool place. Evening's milk should always be kept in the open. Rain can be kept out of the milk by the construction of a small shelter. If the evening's milk is appreciably sour to the taste next morning it should not be used, as the cheese made from it will probably be worthless. Due provision for the winter feed of the stock should have been made by the planting of barley, forage and other green crops. The ensilage pits should have been filled and well weighted down, and should not be opened until August or even later.

DECIDUOUS FRUITS.

Orders should be given to the nurseryman for trees required in August, September or October. Trees will be lifted in August, and may with advantage be kept in cool storage till required.

ENTOMOLOGICAL.

Maize.—"Earworms" are sometimes troublesome in the tassels and ends of the cobs, but this pest cannot be directly attacked. Caterpillars may attack the crop, on account of their food being suddenly destroyed by late cultivation after the weeds have been allowed to get too far ahead.

Tobacco.—Any remaining plants showing stem borer attack should be removed and burnt.

Potatoes.—Should be systematically cultivated and hilled, to keep tuber moth from tubers.

Cabbage Family.—Plants of this family are liable to suffer severely from cabbage louse and *Bagrada* bug.

Beans and Cowpeas.—Insect attack on these plants is but little obvious during April.

Dhal.—Suffers much from blister beetles destroying the blossom during April. Hand picking is the only remedy.

Citrus Trees.—Collect and destroy infested fruit, to keep down citrus codling.

FLOWER GARDEN.

The rains of March have brightened up the flower gardens wonderfully, and at this period of the year they should be bright and gay with autumn flowers. The garden can generally be depended upon to make a good show in the autumn and early winter, provided that the plants have been previously kept in a healthy condition by watering, mulching and feeding. Snap dragons and other seedlings, also cuttings, may now be planted out into their permanent positions. Sowing may be made of hardy annuals, such as hollyhocks, larkspur, clarkia, pansy, petunia, sweet peas, gaillardia and candytuft. Bulbs of spring flowering plants may be taken up, divided and replanted.

VEGETABLE GARDEN.

Sow at once all that is required to fill up the vegetable garden before the soil has parted with all moisture. Seeds sown now will germinate

freely, and plants will establish themselves more quickly than during the colder weather, which can soon be expected. A start should now be made at cleaning asparagus beds. This is a most popular vegetable, and yet one rarely sees it cultivated in the ordinary Rhodesian garden. It is supposed to be difficult to grow, but this supposition is not borne out, as, once established, a bed of asparagus is one of the most easily managed vegetables in the whole garden. Depth of good soil and plenty of manure are all that this plant requires. Rhubarb roots may be taken up, divided and replanted this month. Plant out from seed beds cabbage and onion plants into their permanent quarters. Sow a full crop of peas, broad beans, turnips, onions, lettuce and radish.

FORESTRY.

If any seed has been sown during the previous month the resulting seedlings should be pricked out into tins.

Young trees planted during the season should be looked over, and where double leaders have developed reduce to single stems. Any abnormal branches should be shortened. The same remark applies to trees planted during the previous season. The object sought to be attained is well grown trees of single stems free from heavy branches.

Operations for protecting woods from fire should be put in hand.

Breaking up of new land should be continued where further tree planting operations are contemplated.

POULTRY.

Breeding pens should ere this not only have been mated up, but the first chicks should have been hatched; the early ones always mature more quickly and make better birds than the later ones. From the time the chicks are 48 hours old till they reach maturity, do not stint them in anything, either food, milk, care, cleanliness, housing, etc. Remember that growing stock must have food to produce bone, flesh, fat, feathers, to renew waste and compensate for wear and tear and energy. Don't stint chopped-up onions with young chicks; they encourage growth, are a tonic, and prevent worms and colds. An ample supply of thick milk is most beneficial to the health and growth of chicks. Beware of overcrowding; more chicks die from this cause than from any other.

Commence hatching as many turkey eggs as possible.

Those who are growing sunflowers should pick off all leaves except four or five at the top, and dry, sift and powder, thus producing sunflower leaf meal, which is an excellent green food when others are scarce to mix with the dry mash. If munga has risen in price, substitute sunflower seeds or kaffir corn crushed small. If buckwheat is given, it too should be cracked.

STOCK.

Cattle.—Cattle on the ranch should require little attention beyond dipping. Bulls should be kept out of the herd if January calves are not desired, and care should be taken to see that they are thriving and gaining condition for service again next month.

Towards the end of the month dairy cattle in most districts will begin to require some supplementary food. A small ration of maize if the price permits will be advantageous, but in any case they will repay some extra succulence such as Napier fodder, green maize stalks or ensilage, if any of the latter is left over from the previous year. The same applies to calves; and indeed supplementary food should be given to all dairy stock the moment they shew signs of falling off in condition. An early start tends to lessen the total amount of food required during the winter. All preparations for making ensilage should be completed by the end of the month. Any hay-making left undone should be attended to without delay. Attention should

be given to water supplies for winter, and arrangements made to prevent water holes, etc., being trodden in as the supply shortens.

Sheep.—If grass seeds are troublesome, an area should be mown for grazing. The vleis should be avoided. It will probably be wise to keep the rams out of the flock for another month, so that lambs will not appear before October, when one may reasonably expect some grazing. This, however, is a matter for individual judgment in accordance with the nature of one's own farm or district.

TOBACCO.

Curing will be continued during the month. Care must be taken to yellow the leaf well before drying out. All bales or bulks of cured tobacco should be carefully examined weekly to ascertain the keeping condition of the leaf. Seed heads should be removed when the pods are brown and stored in a cool dry room. Lands should be ploughed and harrowed as soon as all tobacco has been removed.

VETERINARY.

Horse-sickness will be prevalent this month, as will blue tongue in sheep. The first symptom in the latter is laminitis, the second a protruding blue tongue.

WEATHER.

Along the higher ridges of the country we may still look for an inch of rain, more or less, during the month, though little, if any, can be expected in the Zambesi and Limpopo valleys and all low-lying parts of the country. As often as not, however, April is a dry month. In past years it has occasionally happened that early frosts have been recorded which put an end to the tobacco harvest, and may kill tender vegetables and flowers; but, as a rule, no such calamity need yet be expected, and if at all, only in frosty hollows.

May.

BEE-KEEPING.

The scarce supply of nectar, due to conditions of drought, will be responsible for a deficiency of stores. Where this is noticed, steps must at once be taken to supply the bees with artificial food in the shape of syrup. A feeder must be placed above the frames inside the hive. Never feed bees outside, as it promotes robbing.

CITRUS FRUITS.

Continue irrigating bearing orchards up to within three weeks of picking fruit, followed by cultivation and hand hoeing. The same remarks as in April apply concerning insect pests, etc. Washington Navel oranges will be ripening this month, and possibly some early ripening seedlings.

CROPS.

Some maize should be ready for cutting and stooking. Ploughing should be undertaken on all available lands. Winter crops in vleis, such as Early Gluyas and other wheats, oats and barley, should all be sown not later than this month. Napier fodder may still be cut for ensilage, and this will give time for a considerable after-growth, which can serve as winter pasture.

DAIRYING.

(See April.)

ENTOMOLOGICAL.

Cabbage Family.—Plants of this family are liable to suffer greatly from cabbage louse and *Bagrada* bug during May. For the former, spray with soap and tobacco wash, which may help if the plants are not too big.

Dhal.—Blister beetles are still injurious to the blossom of the crop, and should be regularly collected and destroyed.

Citrus Trees.—Continue to collect and destroy all fruits infested with citrus codling.

Guava.—Fruit fly and citrus codling breed in these fruits during the autumn and winter.

FLOWER GARDEN.

The month of May is a suitable one for the preparation of new flower beds. The ground should be well trenched, and if of poor quality, a light dressing of well rotted manure will be a distinct advantage. Too heavy dressing is not advised, as too rich a soil is likely to produce an abundance of foliage and very few flowers. It is not too late to sow sweet pea seeds, but the best results come from early planting. By this time all bulbs for spring flowering will be planted. Chrysanthemums, delphiniums, dahlias and other herbaceous perennials may now be cut down, and if necessary taken up, divided and replanted.

VEGETABLE GARDEN.

It will be necessary during the early part of the month to clear off what remains of summer crops, such as haricot beans, peas, cucumbers, etc. Where winter deep rooting vegetables are to be grown, such as carrots, parsnips and beets, the soil and sub-soil should be deeply worked, so as to allow a ready root run for these vegetables. A dressing of lime will be of great value in every section of the kitchen garden. This will especially help to minimise future attacks of insects and fungus attacks. New asparagus beds may be made this month; old beds should be cut down, cleaned and kept in good order; also a light dressing of stable manure may be given to the beds. Planting may be made of all seedlings, such as cabbage, cauliflower, lettuce, onions, etc., and seeds of carrot, leek, lettuce, onions, peas, radish, turnip, parsnip, broad beans may be sown.

FORESTRY.

Continue pricking out seedlings into tins. Deciduous trees which are propagated by means of cuttings should be taken in hand.

See that the fire lines are in order, and in the case of woods which have formed canopy remove inflammable material below the edge trees.

Place orders for any trees proposed to be planted during the ensuing season, so that nurserymen may make provision.

POULTRY.

It will now be possible to tell the sex of those chicks hatched at the commencement of last month. Separate the cockerels from the pullets. Go over the cockerels and select a few of the sturdiest, the ones with the deep bodies and round heads, and those which grow quickest; these will make the best breeding birds and should be kept. The remainder should either be killed and used for making chicken pie, or fed a fattening ration and got off to market as soon as possible.

Beware of allowing young turkeys to become wet; it is fatal to them. Their chief food should consist of chopped-up onions or onion tops and thick

separated milk. They should be fed in the same way as chickens, that is, dry food, small grain and plenty of green food and thick separated milk.

Those going in for ducks should hatch as many as possible, and get them out in relays every three to four weeks; give all the food they will eat from the time they are hatched. A quick growing duck should put on 1 lb. per week, and be ready for killing at from seven to eight weeks old. Always kill or sell for killing just before the main wing feathers commence to grow.

The poultry keeper should never chop and change treatment in any way. If the birds are doing well on a certain menu, it should not be altered; if not, make the change gradually. Sudden changes in surroundings, houses, food, etc., always put the birds off the lay; it is much easier to stop a bird laying than to bring her on again. Poultry keepers and farmers should not wait for the market to come to them, nor expect to sell all their eggs locally at good prices. Small places are soon overstocked with eggs, but try to find markets further afield by advertising and applying direct to hotels, boarding houses, etc.

STOCK.

Cattle.—Ranching cattle may still be expected to be in good condition. In most districts it will be wise to conserve hay, maize stover, ensilage and a supply of any other cheap feed as a provision against possible late rains in the spring, and to enable one to maintain the younger or very old stock should occasion arise. By the middle of this month dairy cattle will require more serious attention in the matter of feed, and in this connection we would refer our readers to Bulletin No. 345. Grass should be cut for bedding and both cows and calves should be well bedded down at night from now onwards, and cowsheds should be put in good repair. Attention should be given to the water supplies and care taken that they are clean and sufficient.

Sheep.—The vleis having dried, sheep may be allowed into the lower lying veld. If the rams are put in now, lambs will arrive in October, which is usually a good month to arrange for. Those who favour winter lambs and have ewes lambing now will find a few handfuls of maize, together with chopped maize stalks or any other kind of available roughage or green stuff, a great help to the ewes in providing milk. (See Bulletin 287.)

TOBACCO.

Curing should be finished as early in the month as possible, to prevent loss from frost. The bales or bulks of cured tobacco should be examined weekly until sent to the warehouse. Tobacco seed should be shelled as soon as the seed pods are dry, and the seed carefully labelled and stored. All tobacco lands should be ploughed and harrowed.

VETERINARY.

Horse-sickness will still be in evidence, and may be expected to continue until the frosts occur. Inoculation for blue tongue should be performed in the dry season only, unless the animals can be kept under cover for 21 days. Do not inoculate ewes in lamb on account of abortion. Inoculated animals spread the disease for 21 days. Scab is a poverty winter disease.

WEATHER.

The dry season should have now set in, though averages of from a quarter of an inch to three-quarters are indicated in the official reports. Ground frosts at night have been recorded, but are very unusual.

Agricultural Outlook.

For the great majority of crops the season has been ideal. The maize crop is certainly a record in acreage and yield, but the latter has, during the past couple of weeks, suffered a set-back through excessive rains. The area under maize for grain grown by Europeans is 215,066 acres, and the yield may be forecasted at this date at about 1,400,000 bags, though this figure is subject to correction as the crop matures. The returns for native crops are not yet available, but these crops are also abundant. Our probable export will approach 1,000,000 bags; though it may not quite reach the seven figures. It has never been so high before, and last year virtually none was exported.

The railway administration have announced that the overseas export rate for maize and kaffir grain *via* Beira from points within the 300-600 mile zone during the coming season will be 15s. per ton, including pierage. Farmers should see that their maize is thoroughly dry before it is stacked at the railway siding, otherwise it will mould very rapidly. There are excellent crops of ground nuts, but if the rains continue the first formed nuts, which are usually the best, may commence to make second growth. The heavy and continuous rains have made it difficult to harvest early sown crops such as haricot beans, linseed and buckwheat, and a dry spell would be very welcome. Sudan grass has rusted badly this year, and farmers have been compelled to mow it off. A second growth may, however, be expected. Majorda melons and tepary bean, both of which thrive best under semi-arid conditions, have suffered from the excessive rain. Hay making has, of course, been postponed unduly, and the hay crop will consequently not be of very good quality, as many of the best grasses have seeded.

The acreage planted to tobacco this season was approximately the same as last year, but a considerably reduced crop is expected, due to the exceptional rains and angular spot. A good deal of the leaf is very thin and lacking in body. Growers are experiencing difficulty in curing the crop owing to the saturated condition of the atmosphere. Harvesting has also been a difficult proposition, as many fields are waterlogged, and the tobacco has had to be transported to the curing barn by hand. In some of the bulks tobacco is heating owing to the wet weather.

The recent Tobacco Conference at Capetown was due to the initiative of Southern Rhodesia. It was notably successful in that it virtually formulated a common policy of tobacco growers of the Union, Southern and Northern Rhodesia, and Nyasaland, and made important recommendations to all the Governments concerned. A reference to this conference is made in an editorial notice.

Extensive moist vlei areas will be available for the sowing of winter cereals, and a large addition to the wheat crop may be anticipated.

The condition of cattle is everywhere reported to be excellent, and there should be ample supplies of water and pasturage to carry them through the dry season.

Review.

"FARMING OPPORTUNITIES IN SOUTH AFRICA."

The Publicity Department of the South African Railways and Harbours has issued a revised and enlarged edition of "Farming Opportunities in South Africa." This book, which is published for circulation overseas as an adjunct to the advertising campaign of the Union Administration, is designed to give greater prominence to the opportunities that exist in South Africa for men with the necessary capital to engage successfully in one or other of the several branches of agriculture that are available in the country. It discusses from many aspects the possibilities of profit and the attendant difficulties in the different main lines of farming, and should convey to the overseas reader a fair idea of the conditions of life and prospects on a South African farm. The book has been compiled in collaboration with the Department of Agriculture, and the information set forth may be taken as authoritative. The difficulties are certainly not minimised, and we do not think that the profits to be gained are placed too high. As is stated in the preface, the present is perhaps not the most fortunate time for describing the farming opportunities of any country. The conditions as they exist to-day are presented dispassionately, and the fund of information provided should be of the greatest assistance to the prospective settler. The Publicity Department is to be congratulated upon the production of a book which is one of the most comprehensive of its type we have seen, and which is admirably suited for the purpose for which it is written.

Southern Rhodesia Veterinary Report.

January, 1923.

AFRICAN COAST FEVER.

CHARTER DISTRICT.—A fresh outbreak occurred on the farm Totton, involving 347 head of cattle. Mortality :—Totton, 1; Swartfontein, 2; Chipisa, 2; Rooipoort, 4.

MELSETTER DISTRICT.—At the Merino infected centre 18 head were destroyed.

SWEATING SICKNESS OF CALVES.

The heavy rains were no doubt responsible for the very large increase in all districts in the number of cases of this undetermined affection, particularly Bulawayo, Matobo and Plumtree.

EPHEMERAL FEVER

(three-day sickness of cattle).

A few cases reported from the Gwanda district.

HORSE-SICKNESS.

The following mortality was reported :—Salisbury, 1; Mazoe, 1; Hartley, 3; Bulawayo, 21; Matobo, 3; Nyamandhlovu, 1; Inyati, 1; Gwanda, 6; Victoria, 8; Gwelo, 5; Selukwe, 4; Charter, 9; Shabani, 1; Umvuma, 5; Untali, 3; Makoni, 6; Inyanga, 8; Melsetter, 1. With the exception of 7 mules at Bulawayo and 2 at Matobo, all the animals affected were horses.

IMPORTATIONS.

From the United Kingdom :—Heifers, 4. From the Union of South Africa :—Heifers, 16; horses, 4; sheep, 635; goats, 265. From Portuguese East Africa :—Donkeys, 5.

EXPORTATIONS.

To the Union of South Africa :—Slaughter cattle, 895; breeding cattle, 4. To Belgian Congo :—Sheep, 40; goats, 25. To Northern Rhodesia :—Bulls, 5; breeding stock, 18; horses, 5; mules, 4; sheep, 25; goats, 25. To Portuguese East Africa :—Horses, 6; mule, 1; donkeys, 13; bulls, 5; cows, 54; calves 16; oxen, 64; sheep, 251; goats, 110.

J. M. SINCLAIR.

Chief Veterinary Surgeon.

Southern Rhodesia Weather Bureau.

JANUARY AND FEBRUARY, 1923.

Pressure.—During the month of January the mean barometric pressure was below normal over the whole country, varying from 0.03 below normal at Bulawayo to 0.05 below normal at Salisbury. The fluctuations in barometric pressure during the month were small, amounting to 0.19 at Salisbury and 0.15 at Gwelo. A high pressure area was present on the 5th and 6th; the maximum high at Bulawayo was on the 5th, being 0.07 above normal, and on the 6th at Salisbury, being 0.06 above normal. Low pressure areas were present on the 13th to 16th and on the 24th and 25th; the minimum low at Bulawayo was 0.11 below normal on the 14th, and at Salisbury 0.13 below normal on the 24th.

During the month of February the mean barometric pressure was below normal over the whole country, varying from 0.08 below at Salisbury to 0.02 below at Gwelo. The fluctuations in barometric pressure during the month were large, amounting to 0.30 at Gwelo and 0.24 at Salisbury. High pressure areas were present from the 2nd to the 7th and from the 22nd to 24th, the maximum high being 0.08 above normal on the 3rd. A low pressure area was present from the 11th to the 15th, the minimum low being 0.21 below normal on the 12th.

Temperature.—During January the mean temperature varied from 1.4° and 1.3° above normal at Gwelo and Salisbury respectively to 0.5° below normal at Bulawayo and Umtali. The mean daily temperature varied from 2.6° above normal at Salisbury to 2.6° below normal at Bulawayo, whilst the mean night temperature varied from 3.4° above normal at Gwelo to normal at Salisbury. During February the mean temperature varied from 0.2° above normal at Salisbury to 0.7° below normal at Umtali. The mean daily temperature varied from 0.3° above normal at Salisbury to 3.6° below normal at Gwelo, whilst the mean night temperature varied from 2.5° above normal at Gwelo to 0.1° above normal at Salisbury.

January Rainfall.—During January the rainfall was above normal over the whole country with the exception of Zone D, where it was 1.0 inch below normal.

The mean rainfall recorded in the various zones during January was as under:—

	Mean rainfall. Inches.	Mean normal January rainfall. Inches.
Zone A (Western Matabeleland)	8.21	6.14
Zone B (South-Eastern Matabeleland) ...	8.64	5.90
Zone C (Western Mashonaland)	8.76	7.57
Zone D (North-Eastern Mashonaland) ...	7.12	8.16
Zone E (South-Eastern Mashonaland) ...	10.50	7.76
Zone F (Eastern Border)	17.33	11.80

In Zone A, the district with the greatest mean rainfall was Wankie, with 9.26, and the district with the least mean rainfall was Insiza, with 7.34 inches. The heaviest rainfall during the month was 10.83 inches, recorded at Waterford (Wankie district), and the least, 6.16 inches, recorded at Maria farm (Bubi district).

In Zone B, the district with the greatest mean rainfall was Insiza, with 11.16 inches, and the district with the least mean rainfall was Gwanda, with 7.01 inches. The heaviest rainfall during the month was 14.65 inches, recorded at Infiningwe (Insiza district), and the least, 5.26, recorded at Umfula (Matobo district).

In Zone C, the district with the greatest mean rainfall was Chilimanzi, with 9.66 inches, and the district with the least mean rainfall was Salisbury, with 6.93 inches. The heaviest rainfall during the month was 13.63 inches, recorded at Marshbrook (Charter district), and the least, 3.42 inches, recorded at Mapandaguta (Lomagundi district).

In Zone D, the district with the greatest mean rainfall was Salisbury, with 9.67 inches, and the district with the least mean rainfall was Mtoko, with 5.28 inches. The heaviest rainfall during the month was 12.45 inches, recorded at The Meadows (Salisbury district), and the least, 3.80 inches, recorded at Sunnyside (Mazoe district).

In Zone E, the district with the greatest mean rainfall was Melsetter, with 15.00 inches, and the district with the least mean rainfall was Insiza, with 2.55 inches. The greatest rainfall during the month was 23.03 inches, recorded at Park farm (Umtali district), and the least, 1.45 inches, recorded at Chilimanzi.

In Zone F, the greatest rainfall recorded during the month was 18.98 inches, recorded at Hoboken (Umtali district), and the least, 14.20 inches, recorded at Chikore (Melsetter district).

Rain Periods.—During the 1st and 2nd rain was only recorded at a few stations in the Territory. During the 3rd to the 5th light showers were general over the whole country; whilst on the 6th only a few stations reported rain. For the remainder of the month almost continuous rain was general over the whole Territory.

February Rainfall.—During February the rainfall was considerably above normal over the whole country. The mean rainfall recorded in the various zones during February was as under:—

	Mean rainfall. Inches	Mean normal February rainfall. Inches.
Zone A (Western Matabeleland)	7.19	4.68
Zone B (South-Eastern Matabeleland) ...	6.66	3.69
Zone C (Western Mashonaland)	8.80	7.30
Zone D (North-Eastern Mashonaland) ...	12.25	7.46
Zone E (South-Eastern Mashonaland) ...	10.06	6.72
Zone F (Eastern Border)	14.51	10.55

In Zone A, the district with the greatest mean rainfall was Bubi, with 8.07 inches, and the district with the least mean rainfall was Nyamandhlovu, with 6.11 inches. The greatest rainfall was 10.27 inches, recorded at Imbesu Kraal (Bubi district), and the least, 2.94 inches, recorded at Gwaai reserve (Nyamandhlovu district).

In Zone B, the district with the greatest mean rainfall was Umzingwane, with 8.02 inches, and the least Gwanda, with 4.11 inches. The heaviest rainfall was 9.47 inches, recorded at Matopo Park (Matobo district), and the least, 2.90 inches, at the Limpopo (Gwanda district).

In Zone C, the district with the greatest mean rainfall was Lomagundi, with 11.34 inches, and the least Chilimanzi, with 7.01 inches. The heaviest rainfall was 16.14 inches, recorded at Baguta (Lomagundi district), and the least, 5.14 inches, at Rhodesdale Ranch (Gwelo district).

In Zone D, the district with the greatest mean rainfall was Mtoko, with 14.68 inches, and the least Makoni, with 10.52 inches. The heaviest rainfall was 19.46 inches, recorded at Makaha (Mtoko district), and the least, 7.53 inches, recorded at Forest Hill (Makoni district).

In Zone E, the district with the greatest mean rainfall was Melsetter, with 15.68 inches, and the least Insiza, with 6.69 inches. The heaviest rainfall was 26.62 inches, at Stapleford (Umtali district), and the least, 4.46 inches, recorded at Victoria (Victoria district).

In Zone F, the heaviest rainfall was 25.26 inches, at Hoboken (Umtali district), and the least, 9.29 inches, recorded at Melsetter (Melsetter district).

Rain Periods.—During the 1st and 2nd rain was general in Mashonaland, but only slight showers occurred in Matabeleland; during the 3rd and 4th only slight showers occurred over the whole country; whilst on the 5th rain was general in Mashonaland. From the 6th to the 18th rain was general over the whole country; but during the 19th to 22nd only slight showers were reported, chiefly in Mashonaland. The 23rd to the end of the month was another wet period, during which rain was general over the whole country.

General Summary.—During the whole period up to the end of February the weighted mean rainfall over the whole country was 4.21 inches above normal, and was above normal in all the zones.

The mean rainfall recorded in the various zones for the period July to December is as under:—

	Mean rainfall. Inches.	Normal mean rainfall, July to December. Inches.
Zone A	22.56	20.63
Zone B	22.59	17.64
Zone C	26.88	25.15
Zone D	32.48	26.36
Zone E	29.40	25.56
Zone F	48.89	39.44

RAINFALL

STATION.	1923.		Total to end of period.	Normal rainfall to end of period.
	Jan.	Feb.		
ZONE A.:				
Bubi—				
Imbesu Kraal	7.49	10.27	24.09	20.70
Inyati	7.38	6.99	24.17	20.26
Maria Farm	6.16	7.46	21.67	n.s.
Shangani Estate	9.21	7.57	24.72	19.23
Bulalima—				
Kalaka	7.34	7.68	24.70	19.60
Riverbank	9.16	7.31	25.50	20.61
Bulawayo—				
Fairview Farm	7.05	5.80	21.97	19.32
Keendale	7.63	7.32	23.01	18.10
Lower Rangemore	10.37	7.45	26.46	20.51
Observatory	6.74	...	...	19.56
Gwelo—				
Dawn	8.83	6.72	22.45	20.40
Somerset Estate	8.36	9.02	22.98	20.96
Insiza—				
Thornville	7.34	7.50	22.91	22.21
Nyamandhlovu—				
Gwaai Reserve	8.15	2.94	18.01	n.s.
Impondeni	8.79	6.57	23.75	...
Naseby	7.70	...	...	20.28
Paddy's Valley	7.29	8.83	24.54	19.40
Wankie—				
Lynwood	7.68	3.78	16.64	23.99
Waterford	10.83	9.14	30.24	n.s.
Sebungwe—				
Gokwe	8.74	7.23	26.72	25.55
ZONE B.:				
Belingwe—				
Bickwell	11.17	...	...	19.20
Bubje Ranch	9.24	7.71	22.74	18.90
Bulalima—				
Edwinton	7.34	5.43	20.94	17.86
Garth	6.70	6.85	22.32	22.40
Maholi ... ..	...	...	...	21.80
Retreat	9.37	5.99	22.56	17.96
Sandown	7.85	8.39	25.89	n.s.
Tjompanie	9.71	3.50	18.68	20.32
Gwanda—				
Gwanda Gaol	7.47	6.48	21.87	17.74
Insindini	6.15	...	...	n.s.
Limpopo	9.33	2.90	20.03	n.s.
Tuli	5.55	3.07	13.04	12.17
Insiza—				
Albany	8.87	9.13	24.93	17.75
Filabusi	9.94	4.96	21.50	18.70
Fort Rixon	10.21	4.82	23.03	18.72
Infiningwe	14.65	7.43	31.11	21.95
Lancaster	12.13	5.24	24.36	n.s.

RAINFALL—(Continued).

STATION.	1923.		Total to end of period.	Normal rainfall to end of period.
	Jan.	Feb.		
ZONE B.—(Continued)				
Matobo—				
Holly's Hope	...	...	...	17.79
Mtshabezi Mission	8.51	...	...	18.72
Matopo Mission	7.46	7.65	25.70	21.77
Rhodes Matopo Park	8.73	9.47	28.51	19.61
Umfula	5.26	6.10	18.84	n.s.
Umzingwane—				
Essexvale	8.72	9.26	28.70	19.94
Kodhwayo	7.88	6.78	22.12	n.s.
ZONE C.:				
Charter—				
Bushy Park	6.83	6.51	25.99	22.34
Enkeldoorn	6.38	7.14	21.39	24.31
Marshbrook	13.63	9.06	30.21	25.00
Range	8.05	8.65	24.82	26.23
Umnati	7.72	...	...	19.92
Vrede	7.63	7.46	23.76	23.48
Chilimanzi—				
Allanberry	10.00	7.34	22.56	20.86
Central Estates	9.32	6.67	24.43	23.18
Gwelo—				
Cross Roads	9.31	9.19	25.29	21.70
East Clare Ranch	10.12	5.92	19.89	n.s.
Globe and Phoenix Mine	7.60	10.24	25.74	24.00
Gwelo Gaol	9.10	10.44	28.23	22.26
Indiva	10.83	7.99	23.94	n.s.
Lyndene	11.09	6.97	26.86	n.s.
Rhodesdale Ranch	8.40	5.14	20.30	22.00
Hartley—				
Ardgowan	7.52	9.27	26.77	25.70
Balwearie	6.94	9.48	28.65	n.s.
Beatrice...	5.61	10.32	28.09	24.10
Carnock	7.45	8.60	32.62	25.72
Philiphlaugh	7.11	9.71	31.25	27.98
Cromdale	9.12	8.23	29.32	n.s.
Elvington	10.27	10.15	32.21	27.38
Gatooma	8.56	8.19	30.33	26.93
Gowerlands	7.54	8.60	28.95	25.20
Hallingbury	5.88	11.09	27.76	23.85
Hartley Gaol	13.32	8.81	33.70	27.50
Hopewell	7.23	9.71	28.79	...
Jenkinstown	9.07	7.88	28.60	25.02
Ranwick	9.31	7.85	29.67	25.60
Spitzkop	6.32	8.48	24.17	25.90
Lomagundi—				
Argyle	8.35	9.98	30.41	28.18
Baguta	7.65	16.14	38.22	25.49
Citrus Estate	5.03	10.00	31.67	26.42
Darwendale	5.69	7.33	26.17	25.71

RAINFALL—(Continued).

STATION.	1923.		Total to end of period.	Normal rainfall to end of period.
	Jan.	Feb.		
ZONE C.—(Continued)				
Lomagundi (Continued)—				
Dingley Dell ...	8.36	8.35	29.94	n.s.
Freda ...	8.17	10.32	28.12	n.s.
Gambuli ...	7.90	12.18	32.38	30.49
Gungurubee ...	7.74	8.42	30.01	n.s.
Impingi...	5.28	14.68	34.61	n.s.
Lone Cow Estate ...	7.47	...	...	31.20
Mafoota ...	7.58	11.52	34.63	n.s.
Maningwa ...	11.66	13.91	41.28	28.24
Mapandagutu ...	3.42	...	...	n.s.
Mukwe River Ranch ...	5.08	9.60	24.99	26.04
Nyapi ...	6.35	14.89	33.41	n.s.
Nyaroro ...	9.45	14.00	35.49	n.s.
Nyati ...	6.84	...	...	n.s.
Palm Tree Farm ...	4.42	8.52	22.17	26.00
Richmond ...	8.37	8.97	26.99	n.s.
Sangwe ...	9.87	11.33	36.63	n.s.
Silater Estate ...	7.02	...	...	n.s.
Sinoia ...	6.92	11.98	35.44	25.46
Sipolilo ...	8.34	15.59	36.54	25.81
Talfourd ...	7.41	10.95	34.81	27.95
Umboe ...	7.96	8.48	32.33	n.s.
Univukwe Ranch ...	6.25	10.37	32.80	27.51
Salisbury—				
Avondale ...	6.48	9.28	30.18	27.29
Botanical Experiment Station...	7.36	9.66	28.94	27.40
Bromley ...	8.35	10.49	31.81	28.56
Cleveland Dam ...	5.19	10.44	28.42	25.00
Gwebi ...	7.11	12.42	34.46	28.25
Hillside ...	7.24	7.30	29.55	25.06
Lilfordia ...	4.50	14.37	28.65	26.44
Lochinvar ...	5.21	7.67	25.83	n.s.
Manor Farm ...	9.16	12.44	37.42	n.s.
Salisbury Gaol ...	5.75	11.17	32.13	26.07
Sebastopol ...	9.99	10.66	32.88	26.45
Selby ...	6.65	13.44	37.08	24.21
Stapleford ...	8.77	12.59	40.72	28.26
Tisbury ...	6.06	9.80	32.30	26.10
Vainona ...	4.92	...	...	27.67
Sebungwe—				
Sikombela ...	8.86	7.59	25.19	23.63
ZONE D. :				
Darwin—				
La Belle Esperance...	6.28	10.41	25.84	n.s.
Mount Darwin ...	6.76	13.62	30.78	25.49
Inyanga—				
Inyanga ...	9.01	10.28	33.78	30.75
Juliasdale ...	9.09	13.00	35.62	n.s.
Rhodes Estate ...	7.12	10.57	32.32	29.95
York ...	5.79	13.27	30.91	

RAINFALL—(Continued).

STATION.	1923.		Total to end of period.	Normal rainfall to end of period.
	Jan.	Feb.		
ZONE D (Continued)				
Makoni—				
Eagle's Nest	8.74	12.10	35.68	26.23
Forest Hill	7.77	7.53	27.78	29.60
Riversdale... ..	9.20	8.50	32.90	n.s.
Wensleydale	6.97	13.95	34.55	25.50
Mazoe—				
Atherstone	6.11	11.35	29.61	n.s.
Avonduur	8.50	12.33	35.42	30.85
Benridge	7.79	12.31	30.19	28.17
Bindura	7.91	12.59	32.40	27.11
Ceres	10.66	14.38	38.24	30.66
Chipoli	6.61	15.63	31.32	27.46
Citrus Estate	7.32	12.36	33.95	25.31
Craigengower	4.95	13.54	35.81	28.78
Glen Divis	8.26	12.75	35.23	n.s.
Great B	9.05	...	...	n.s.
Kilmer	5.36	12.94	34.91	28.61
Kingston	8.00	15.58	38.36	30.27
Mazoe	6.80	15.39	32.36	26.78
Marienzi	5.94	11.86	29.96	n.s.
Marston... ..	5.42	10.00	24.58	n.s.
Mgutu	8.79	12.94	37.33	25.24
Omeath	7.28	10.27	32.92	31.51
Pearson Settlement	9.41	12.44	35.46	n.s.
Ruia	6.96	12.76	35.71	26.70
Ruoko Ranch	6.33	10.87	33.84	25.90
Shamva	6.41	14.66	31.13	27.47
Stanley Kop	4.68	11.26	27.97	25.40
Sunnyside	3.80	11.74	34.36	27.96
Teign	4.25	12.53	33.58	29.40
Usk	9.53	15.98	42.50	n.s.
Virginia	8.34	13.73	38.92	25.41
Visa	5.41	11.10	31.73	n.s.
Woodlands	10.57	16.06	38.16	n.s.
Zombi	6.69	13.25	32.09	30.70
Mrewa—				
Glen Somerset	6.53	11.08	29.87	29.64
Mrewa	7.27	13.08	39.50	29.16
Selous Nek	7.78	11.95	29.81	30.35
Mtoko—				
Makaha	6.43	19.46	36.03	31.03
Mtoko	4.13	9.91	23.43	25.22
Salisbury—				
Arcturus	13.02	10.54	40.43	n.s.
Chindamora Reserve	8.87	10.62	35.52	n.s.
Glenara	9.21	9.52	32.21	26.00
Goromonzi	11.39	10.69	40.19	31.59
Hatchliffe (Borrowdale)	7.41	...	...	27.65
Hillside (Bromley)	10.03	11.45	30.36	26.94
Kilmuir	8.43	11.53	35.74	n.s.
Meadows	12.45	15.36	43.34	31.40

RAINFALL—(Continued).

STATION.	1923.		Total to end of period.	Normal rainfall to end of period.	
	Jan.	Feb.			
ZONE D.—(Continued)					
Salisbury (Continued)—					
Rastenburg	...	9.32	13.48	36.77	n.s.
Springs	...	6.53	10.07	34.09	n.s.
ZONE E.:					
Belingwe—					
Belingwe	...	9.91	8.75	23.55	n.s.
Inferno Ranch	n.s.
Shabani	...	12.68	5.96	25.24	n.s.
Bikita—					
Angus Ranch	...	10.42	6.41	24.51	n.s.
Bikita	...	20.10	16.32	50.66	49.29
Devuli Ranch	...	9.94	4.88	24.49	n.s.
Charter—					
Buhera	...	10.53	7.52	23.51	24.64
Riversdale	...	8.91	...	...	n.s.
Chibi—					
Chibi	...	12.95	...	...	20.08
Chilimanzi—					
Chilimanzi	...	1.45	8.44	24.14	21.51
Driefontein	...	7.97	9.00	26.70	22.46
Felixburg	...	8.37	11.29	24.94	26.20
Grootfontein	...	7.02	...	...	22.88
Induna Farm	...	8.06	6.32	24.25	23.39
Requeza Estate	...	8.53	6.97	21.54	n.s.
Gutu—					
Gutu	...	10.65	6.63	20.79	24.08
Glenary	...	8.61	5.44	20.89	n.s.
M'vimvi Ranch	...	12.68	11.41	30.38	24.00
Tel-el-Kebir	...	7.94	10.76	26.47	23.26
Gwelo—					
Lover's Walk	...	10.07	6.37	24.93	21.48
Oaklands	...	12.50	11.32	33.01	24.33
Partridge Farm	...	10.36	11.94	31.68	23.60
Sheep Run Farm	...	9.99	9.34	27.13	23.50
Insiza—					
Roodeheuvel	...	2.55	6.69	17.11	31.64
Inyanga—					
St. Trias' Hill	...	7.25	11.75	33.28	32.19
Makoni—					
Chitora	...	16.29	6.52	32.41	29.21
Craigendoran	...	10.51	10.24	30.77	24.83
Gorubi Springs	...	7.62	8.37	23.36	30.43
Mona	...	7.90	6.66	25.48	28.71
Monte Cassino	...	4.78	12.78	31.33	28.77
Rusape	...	6.73	...	...	25.24
Springs	...	7.27	9.95	28.30	31.58
Marandellas—					
Bonongwe	...	10.35	..	...	24.82
Delta	...	8.72	11.09	28.50	30.95

RAINFALL—(Continued).

STATION.	1923.		Total to end of period.	Normal rainfall to end of period.
	Jan.	Feb.		
Zone E.—(Continued)				
Marandellas (Continued)—				
Igudu ...	6.05	13.06	25.42	n.s.
Land Settlement ...	9.15	10.98	27.35	28.00
Lendy Estates ...	9.45	11.31	31.01	n.s.
Marandellas ...	10.77	12.86	39.70	28.39
Nelson ...	8.71	9.45	24.84	25.62
Tweedjau ...	7.38	10.98	24.77	29.39
White Gambolo Ranch ...	10.39	9.06	31.21	n.s.
Melsetter—				
Brackenbury ...	13.70	12.31	38.93	37.54
Tom's Hope ...	16.29	19.05	54.63	37.34
Ndanga—				
Doornfontein ...	12.50	6.91	29.55	27.60
Ndanga... ..	14.83	11.76	36.64	31.60
Triangle Ranch ...	...	...	...	n.s.
Selukwe—				
Aberfoyle Ranch ...	11.84	11.47	32.15	25.51
Hillingdon ...	12.54	...	...	25.70
Impali Source ...	9.53	12.52	29.74	n.s.
Makatsi ...	...	...	...	n.s.
Rio ...	13.75	12.03	37.18	24.14
Tewkesbury ...	7.72	10.48	28.78	n.s.
Umtali—				
Argyll ...	9.41	10.93	27.38	26.69
Gilmerton ...	12.95	7.15	25.13	24.39
Jerain ...	6.88	9.02	22.23	27.30
Mutambara Mission ...	11.64	6.81	27.92	24.82
Odzani Power Station ...	10.73	10.66	30.26	28.88
Park Farm ...	23.03	14.75	45.98	n.s.
Premier Estate ...	10.39	11.05	30.57	25.34
Sarum ...	12.20	11.80	33.79	26.71
Stapleford ...	16.00	26.62	55.56	42.10
St. Augustine's Mission ...	12.11	12.65	35.29	n.s.
Umtali (Gaol) ...	14.55	11.92	34.97	25.87
Victoria—				
Brucehame ...	10.28	7.11	25.59	21.41
Cambria ...	8.50	...	...	n.s.
Chevenden ...	10.82	9.61	31.94	n.s.
Clipsham ...	9.73	6.84	26.03	24.34
Glenlivet ...	3.23	11.77	29.58	n.s.
Gokomere ...	10.58	5.46	30.38	21.18
Histonhurst ...	11.98	7.54	31.54	n.s.
Makahori Farm ...	8.89	7.57	27.02	n.s.
Makorsi River Ranch ...	10.90	8.73	28.26	27.20
Mashaba ...	6.34	9.93	28.99	n.s.
Morgenster Mission ...	12.34	12.66	40.90	31.77
M'Sali ...	9.75	5.49	19.95	n.s.
Riverdene North ...	9.31	6.70	28.25	24.50
Salemore ...	12.59	6.70	28.57	n.s.
Silver Oaks ...	7.83	5.38	21.93	23.69

RAINFALL—(Continued).

STATION.	1923.		Total to end of period.	Normal rainfall to end of period.		
	Jan.	Feb.				
ZONE E.—(Continued)						
Victoria (Continued)—						
Stanmore	12.82	6.02	28.34	22.30
Summerton	6.55	5.07	21.46	21.40
Tichidza	16.06	...	...	27.50
Victoria	8.12	4.46	19.89	21.78
Zimbabwe	10.13	9.53	30.12	n.s.
ZONE F.:						
Melsetter—						
Chikore	14.20	12.61	40.50	37.14
Chipinga	15.94	10.36	42.10	36.60
Melsetter	14.74	9.29	35.43	36.04
Mount Selinda	15.31	13.79	44.56	44.76
Vermont	18.22	15.78	57.22	49.29
Umtali—						
Hoboken	18.98	25.26	54.02	45.20

— means nil.

... means no return.

RHODESIAN MILK RECORDS TO DATE.

Name of cow.	Breed.	Commenced record.	Milk in lbs. Latest return.	Butter fat in lbs. Latest return.	Milk in lbs. to date.	Butter fat in lbs. to date.	Time from commencement of record.	Name and address of owner.
Banje ...	Shorthorn	9/8/22	461.3	20.76	3,143.3	122.24	196 days	C. G. T. Cooper, Essexvale.
Betta ...	do	16/8/22	417.9	18.51	3,113.1	129.37	196 do	do do
Fourbob ...	do	4/10/22	478.1	27.35	2,879.8	144.33	189 do	do do
Baby ...	do	1/11/22	410.2	17.64	2,094.4	92.56	140 do	do do
Pepper ...	do	8/12/22	401.1	17.96	1,681.4	81.40	112 do	do do
Zaza ...	do	26/12/22	464.1	22.51	1,711.1	92.86	105 do	do do
Ann ...	do	24/11/22	401.8	22.80	790.3	37.80	89 do	do do
Henrietta*	do	do	472.5	...	1,225	...	84 do	R. C. MacLagan, Rusape.
Spottie*	Ayrshire	1/12/22	220.5	...	430.5	...	56 do	do do
Agnes*	do	24/11/22	286	...	458.5	...	56 do	do do
Red Rose*	Shorthorn	2/2/23	217	...	476	...	14 do	do do
Gladys*	Ayrshire	16/10/22	168	...	168	...	98 do	F. E. Pickering, Fairview, Sinola.
Daisy*	Friesland	20/11/22	595	...	2,177	...	84 do	do do
Cherry*	do	27/11/22	539	...	1,343	...	63 do	do do
Peach*	do	24/10/22	861	...	1,760	...	84 do	do do
Bella*	do	13/8/22	665	...	1,764	...	63 do	do do
Maureen	do	17/9/22	640	24.32	3,999	159.91	161 do	J. S. Struthers, Palm Tree, Sinola
Rosebud	do	8/10/22	437	21.85	2,520	119.52	161 do	do do
Bell ...	do	27/11/22	781	31.24	3,883	161.77	140 do	do do
Cherry Blossom	do	10/12/22	728	36.40	2,600	125.23	91 do	do do
Palm Tree Lucy	do	17/12/22	629	30.19	2,133	103.80	77 do	do do
Moffie ...	do	31/12/22	697	27.88	1,963	77.62	70 do	do do
Snowflake	do	7/1/23	662	23.83	1,481	56.59	56 do	do do
Palm Tree Peach	do	do	836	29.26	1,574	58.78	49 do	do do
Palm Tree Lady	do	6/5/22	595	24.99	1,127	46.27	49 do	do do
Pansy IV.	do	26/8/22	490	...	5,928	...	252 do	C. F. Anthony, Gwelo.
Ruige Emma	do	19/8/22	761	...	3,241	...	140 do	do do
Begonia	do	19/8/22	1,413.5	48.05	9,452.1	321.37	180 do	J. A. Baxter, Victoria Street, Sny.

* These cows are suckling their calves.

N.B.—A gallon of milk weighs approximately 10 lbs.

Dates of Meetings of Farmers' Associations, Southern Rhodesia

(SUBJECT TO ALTERATION)

Name of Association	Place of Meeting	Secretary	1923			
			April	May	June	
Banket Junction ..	Banket Hotel	C. S. Larter	7	5	22	
Beaufort District ..	Beaufort Hall, Beatrix	G. W. Krienke	26	31	28	
Bindura ..	Bindura	G. Askew	14	12	9	
Bromley ..	Bromley	C. J. Shirley	5	3	10	
Darwin ..	Arcadia Farm & Mt. Darwin Store alternately	J. W. Goucher	8	fixed	dates	
Eastern Border (South Melseter)	Good Hope School	J. Radcliff	14	12	9	
Enkeldoorn ..	Enkeldoorn	G. W. Tully	5	12	9	
Falmerise ..	Willard Farm	G. G. Pickering	4	2	6	
Falmerise-Gun ..	Willard Farm	F. W. Bradshaw	14	12	9	
Figtree Branch, R.L. and F.A.	Figtree Hotel	A. S. Will	5	3	7	
Gabazi ..	Hunyani Drift	A. Kelsey-Harvey	21	fixed	dates	
Gatoona ..	Sheep's Hotel	E. Seale	14	17	16	
Gazaland ..	Chirunga Court House	James Ward	14	12	9	
Greystone ..	Various farm houses, Shangani	R. de L. Edmundstone	28	26	23	
Harley ..	Harley Hotel	J. de L. Edmundstone	28	26	23	
Headlands ..	Headlands Station	J. Grevar	..	..	..
Hunter's Road Farmers and Stockowners	Hunter's Road Siding	R. W. Twilley	..	fixed	dates	
Inisa—Shangani ..	Shangani	M. E. Weale	14	12	9	
Inyanga ..	Rhodes Inyanga Estate	E. J. Lucking	17	15	13	
Inyazura ..	Inyazura	C. J. F. Pether	16	14	12	
Lalapansi ..	Lalapansi	C. J. F. Pether	16	21	18	
Lalapansi ..	Lalapansi	F. W. Robertson	6	4	8	
Macheke ..	Macheke	W. L. McLean	..	fixed	dates	
Makwiro ..	Makwiro	James G. Dickson	20	18	15	
Makoni North ..	Makoni South Farm	J. G. Monckton	25	30	27	
Makoni ..	Marandellas Farmers' Hall	Jonel Dohell	14	12	9	
Marandellas, Northern ..	Marandellas	C. W. E. J. Henson	..	..	..
Marandellas, Southern ..	Commercial Hotel, Salisbury	W. E. J. Henson	5	3	7	
Matopo Branch, R.L. and F.A.	Various farm houses	L. Neaks	..	..	..
Maze ..	Glendale	G. G. Coghill	11	fixed	dates	
Maze Central ..	Maze	M. D. Ward	7	4	13	
Melseter ..	Melseter	A. P. R. Smith	6	..	1	
Melseter (North) ..	Font V. Hotel	J. Hartie	17	fixed	dates	
Midlands Farmers and Stockowners	Farm Summerfield	M. Douglas	17	fixed	dates	
Norton and Laidiate District	Norton Store	A. Tulloch	6	fixed	dates	
Nyamandlovu ..	Nyamandlovu	W. Wrench	..	fixed	dates	
Que Que ..	Que Que	E. J. Ross	21	fixed	dates	
Rhodesian Landowners and Farmers	Library Buildings, Bulawayo	H. S. Hopkins	21	16	16	
Selous ..	Various farms	W. T. Simpson	21	16	16	
Sekake ..	Shamva	A. Musson	19	fixed	dates	
Unyankwe ..	Various ranches	Mrs. M. A. Brucewell	14	12	16	
Untali ..	Royal Hotel, Untali	J. S. Holland	5	3	7	
Unyuna District and Stockowners	Unyuna	M. W. Graham	27	25	29	
Victoria ..	Victoria	W. E. J. Henson	27	4	1	
Wankie District ..	Wankie	W. E. J. Henson	27	..	..
Western ..	Plantree Hotel	W. R. Goucher	14	12	9	

Departmental Notices.

The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

BOTANICAL SPECIMENS FOR IDENTIFICATION.

In all cases where a botanical identification is required it is of the utmost importance that the specimens reach the Department of Agriculture in a thoroughly dry condition, free from mildew, and intact, that is not broken in pieces. Whenever possible specimens should comprise main stem or small branch, leaves, flowers, seed vessels and roots or bulbs, though these need not necessarily be on the same plant.

The colour of the flowers and the general form of the plant should be preserved by pressing and drying between two sheets of blotting paper or newspaper. Ordinary plants not excessively succulent can be dried sufficiently in three days, provided the drying papers are changed every day. A heavy weight should be placed on the specimens in order to press them flat.

Correspondents are asked to supply the following particulars as far as possible:—

- (a) height and general appearance of plant or tree;
- (b) class of soil on which found;
- (c) locality and altitude;
- (d) supposed use or properties.

It is advised that specimens be packed between two sheets of cardboard or thin wood, since in this way they will travel long distances without fear of injury.

CO-OPERATIVE EXPERIMENTS: WINTER CEREALS.

With a view to promoting the growing of winter cereals both under irrigation and on vleis soils, and also of introducing new varieties which may prove superior to those at present grown, the following varieties will be available for *free distribution* in small quantities from the beginning of March onwards:—

Wheat—Early Gluyas, Early Australian, Lalkasar Wali, Klein Koren, Black Persian, Pusa 4.

Oats—Kherson's 60-day, Boer oats, Old Cape Boer oats, Ruakura oats.

Barley—Smyrna (malting type).

Rye—Cape early.

Emmer.

Not more than three parcels of seed can be issued to any one applicant.

The terms under which seeds are issued for co-operative experiments are as follows:—

“That the recipient is required at the close of the season to forward to the Department of Agriculture, on forms supplied for that purpose, an accurate report on the result of his experiments with any seeds or plants supplied to him as a free issue.”

Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

AGRICULTURE AND CROPS.

- No. 174. Notes on Hop Growing, by H. Godfrey Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 218. Useful Measurements for Maize, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 320. Maize Grading, by C. Mainwaring.
- No. 327. Linseed, by C. Mainwaring.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 357. Measurement of Land, by F. Eyles, F.L.S., F.S.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Arable Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- No. 394. The Interdependence of Crop Rotation and Mixed Farming, by H. G. Mundy, F.L.S.
- No. 396. Export of Maize.
- No. 397. The Advantage of Autumn and Early Winter Ploughing, by C. Mainwaring.

- No. 399. Green Manuring and Soil Management, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
 - No. 403. Florida Beggar Weed, by H. G. Mundy, F.L.S.
 - No. 407. Wheat—Extracts from Bulletin No. 22, Victoria, Australia.
 - No. 408. The Velvet Bean, by J. A. T. Walters, B.A.
 - No. 416. Grasses of Agricultural Importance in Southern Rhodesia, by H. G. Mundy, F.L.S., G. N. Blackshaw, O.B.E., B.Sc., F.I.C., and E. V. Flack.
 - No. 417. The Ground Nut or Monkey Nut, by C. Mainwaring.
 - No. 422. Improvement of Rhodesian White Maize by Selection, by C. Mainwaring.
 - No. 423. The Common Sunflower, by C. Mainwaring.
 - No. 428. The Sweet Potato, by J. A. T. Walters, B.A.
 - No. 429. Propagation of Kudzu Vine, by H. C. Arnold.
 - No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.
 - No. 445. Production of Maize, by C. Mainwaring.
- Botanical Specimens for Identification.

REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.
- No. 189. The Manuring of Maize on the Government Experiment Farm, Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.
- No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.
- No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.
- No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.
- No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.
- No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.
- No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.
- No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.
- No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.
- No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.
- No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.
- No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.
- No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-1920.
- No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.
- No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.
- No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.
- No. 432. Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S.
- No. 433. Winter Cereal Experiments, 1921, by D. E. McLoughlin.
- No. 437. Annual Report on Crop Experiments, Gwebi, 1921-22, by H. G. Mundy, F.L.S.
- No. 440. Annual Report of Experiments, 1921-22, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.

TOBACCO.

- No. 346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
- No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.
- No. 398. Wildfire and Angular Spot.
- No. 404. Flue-Curing Tobacco Barns and Packing House (Second Revision),
by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.
- No. 410. Common Mistakes in Growing and Handling Virginia Tobacco,
by H. W. Taylor, B.Agr.
- No. 444. Tobacco Seed Beds, by H. W. Taylor, B.Agr.
Handbook of Tobacco Culture for Planters in Southern Rhodesia,
price 2s. 6d., post free outside South Africa 3s. 6d.

STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by
Eric A. Nobbs, Ph.D., B.Sc.
- No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
- No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season
1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood.
- No. 250. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D.,
B.Sc., and B. Haslewood, F.S.S.
- No. 247. Statistical Returns of Crops grown by Europeans in Southern
Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D.,
B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S.,
Statistician.
- No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A.
Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
- No. 286. Statistics of Live Stock and Animal Produce for the Year 1917,
by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and
F. Eyles, F.L.S.
- No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles,
F.L.S.
- No. 361. Statistics of Live Stock and Animal Produce for the Year 1919,
by F. Eyles, F.L.S.
- No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia,
1919-1920, by H. C. K. Fynn.
- No. 393. Statistics of Live Stock and Animal Produce for 1920, by
H. C. K. Fynn.
- No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia
for the season 1920-21, by H. C. K. Fynn.
- No. 426. Statistics of Live Stock and Animal Products for the year 1921,
by H. C. K. Fynn.
- No. 443. Statistics of Crops Grown by Europeans in Southern Rhodesia
for the Season 1921-22, by F. Eyles, F.L.S., and H. C. K.
Fynn.

LIVE STOCK.

- No. 145. Prospects of Importation of Cattle from Australia, by E. A.
Nobbs, Ph.D., B.Sc.
- No. 208. Water in the Diet of Live Stock, by L. E. W. Bevan, M.R.C.V.S.
- No. 210. The Care and Feeding of Calves in Dairy and Stud Herds, by
R. C. Simmons.
- No. 211. Fattening of Pigs on Granite Farms in Mashonaland, by
R. C. Simmons.
- No. 227. An Experiment in Beef Production, by R. C. Simmons.
- No. 245. Beef Feeding Experiment No. 2, by R. C. Simmons.
- No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by
A. G. Holborow, F.I.C., Assistant Government Agricultural
Chemist.

- No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.
 No. 255. Pound Fees.
 No. 287. Sheep Farming for Mutton Purposes on Granite Veld and Mixed Farms, by R. C. Simmons.
 No. 292. Branding and Drafting Pens, by R. C. Simmons.
 No. 321. The Construction of Dipping Tanks for Cattle. Revised April, 1919.
 No. 336. Butchering and Flaying.
 No. 338. From Breeder to Butcher; Beef Feeding Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.
 No. 340. Notes on Theory and Practice of Feeding Cattle in Southern Rhodesia, Part III., by R. C. Simmons.
 No. 345. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part IV., by R. C. Simmons.
 No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
 No. 392. Memorandum on the Cattle Industry of Southern Rhodesia, 1921.
 No. 421. From Breeder to Butcher: Cattle Feeding Experiment No. 9, Government experiment farm, Gwebi, by E. A. Nobbs, Ph.D., B.Sc., F.H.A.S.
 No. 446. From Breeder to Butcher: Cattle Feeding Experiment No. 11, Government Experiment Farm, Gwebi, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.
 No. 448. The Cattle Industry.
 ————— Arsenite Cattle Dip—How to Mix.

DAIRYING.

- No. 277. A Farm Cheese and Butter Dairy, by R. C. Simmons and G. U. Fripp.
 No. 328. Pont l'Eveque Cheese, by J. B. Fisher, N.D.D.
 No. 329. Gervais Cheese, by J. B. Fisher, N.D.D.
 No. 356. Cream and its Production, by T. Hamilton.
 No. 370. Development of Flavour in Butter, by T. Hamilton, M.A., N.D.A., N.D.D.
 No. 383. Control of Temperature in Dairying, by T. Hamilton, M.A., N.D.A., N.D.D.
 No. 395. Farm Butter Making, by T. Hamilton, M.A., N.D.D., N.D.A.
 No. 401. Milk Records and Milk Testing, by T. Hamilton, M.A., N.D.A., N.D.D.
 No. 418. Manufacture of Cheddar Cheese, by T. Hamilton, M.A., N.D.A., N.D.D.
 No. 427. Common Defects in Butter-making, by T. Hamilton, M.A., N.D.A., N.D.D.
 No. 449. Farm Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D.

VETERINARY.

- No. 51. Strangles, by F. D. Ferguson, M.R.C.V.S.
 No. 121. Rabies, by L. E. W. Bevan, M.R.C.V.S., and T. G. Millington, M.R.C.V.S., D.V.H.
 No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
 No. 313. Obstruction in Sheath of Ox, by J. M. Sinclair, M.R.C.V.S.
 No. 316. Inoculation of Cattle against Redwater and Gall-sickness, by L. E. W. Bevan, M.R.C.V.S.
 No. 352. African Coast Fever, by L. E. W. Bevan, M.R.C.V.S.
 No. 364. Round-worm Infection of Calves, by H. E. Hornby, M.R.C.V.S.
 No. 367. Quarter-evil, by C. R. Edmonds, M.R.C.V.S.

- No. 431. History, Control and Treatment of Infectious Abortion in Cattle in Southern Rhodesia, by L. E. W. Bevan, M.R.C.V.S.
 No. 435. A Short History of Infective Diseases, by J. M. Sinclair, M.R.C.V.S.
 Redwater Treatment and Gall Sickness.
 Services of Government Veterinary Surgeons.

IRRIGATION.

- No. 206. Hints on Irrigation: Small Earthen Storage Reservoirs, by W. M. Watt.
 No. 270. Odzani River Irrigation Scheme, by W. M. Watt.
 No. 300. The Dangers and Prevention of Soil Erosion, by W. M. Watt.
 No. 349. The Hydraulic Ram, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.
 No. 376. Notes on the Water Law of Southern Rhodesia, by R. McIlwaine, M.A., LL.B.
 No. 384. The Application of Water in Irrigation, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.
 No. 400. Soil Washing, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.
 No. 412. Water Power Resources of Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
 No. 419. Irrigation Canals, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E. Engineering Advice.

FORESTRY.

- No. 199. Eucalypts for the Farm, by J. J. Boocock.
 No. 366. The Management of Woods, by J. S. Henkel.
 No. 379. Price List of Forest Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds.
 No. 386. Forestry in Rhodesia: Improvement Fellings on the Farm, by J. S. Henkel.
 No. 439. Forestry in Rhodesia: Planting and Care of Forest Trees, by J. S. Henkel.

HORTICULTURE.

- No. 75. Fumigation of Fruit Trees with Hydrocyanic Acid Gas, by R. W. Jack, F.E.S.
 No. 354. The Home Orchard, by A. G. Turner.
 No. 424. Citrus Fruit Growing in Rhodesia, by A. G. Turner.

ENTOMOLOGY AND VEGETABLE PATHOLOGY.

- No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.
 No. 147. Root Gallworm, by R. W. Jack, F.E.S.
 No. 158. Two Ladybirds Injurious to Potato Plants, by R. W. Jack, F.E.S.
 No. 171. The Cabbage Web-Worm—A Pest of Cabbage and Allied Plants, by R. W. Jack, F.E.S.
 No. 172. Diseases of the Potato Tuber and the Selection of Sound Seed, by R. W. Jack, F.E.S.
 No. 178. Illustrations of Natural Forest in relation to Tsetse Fly, by R. W. Jack, F.E.S.
 No. 187. The Dusty Surface Beetle, by Rupert W. Jack, F.E.S.
 No. 197. Chafer Beetles, by R. W. Jack, F.E.S.
 No. 204. Some Injurious Caterpillars, by R. W. Jack, F.E.S.
 No. 214. Some Household Insects, by R. Lowe Thompson, B.A.
 No. 219. More Household Insects, by R. Lowe Thompson, B.A.
 No. 228. Rhodesian Citrus Pests, by R. W. Jack, F.E.S.

- No. 233. Does it Pay to Spray Potatoes in Southern Rhodesia? by Rupert W. Jack, F.E.S.
- No. 249. Home-made Fly Papers, by Rupert W. Jack, F.E.S., Government Entomologist.
- No. 261. Turnip Sawfly, by R. W. Jack, F.E.S.
- No. 276. The Maize Stalk Borer, by Rupert W. Jack, F.E.S.
- No. 280. The Maize Beetle, by R. W. Jack, F.E.S.
- No. 290. Notes on Remedies for Turnip Sawfly, by Rupert W. Jack, F.E.S.
- No. 291. Cutworms, by Rupert W. Jack, F.E.S.
- No. 302. A Note on the Maize Stalk Borer, by Rupert W. Jack, F.E.S.
- No. 317. Maize Culture on Red Soil; Value of Poisoned Bait as an Aid to Good Stands, by Rupert W. Jack, F.E.S.
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- No. 283. Maize Foods for the Home.
- No. 294. Directions for taking Samples for Analysis, by E. V. Flack, Acting Agricultural Chemist.
- No. 318. Notes on Mining Law for Farmers, by Advocate D. E. McCausland, M.A., LL.B.
- No. 358. Notes on the Regulations governing the Sale of Fertilisers and Farm Foods, by E. V. Flack.
- No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
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- No. 447. Composition and Fertilising Value of Wood Ash and other Ashes, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
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- The Analyses of Agricultural Products, Soils, Water, etc.
- Lectures for Farmers.
- Farming Returns for Income Tax Purposes.

Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 71 of 1923.]

[9th February, 1923]

RABIES.

HIS Honour the Acting Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 519 of 1922, prohibiting the introduction of dogs from the Bechuanaland Protectorate.

No. 113 of 1923.]

[16th March, 1923.]

GLENDALÉ-VISA ROAD, MAZOE DISTRICT.

IT is hereby notified that His Honour the Acting Administrator has been pleased, under the provisions of section 2 of "The Road Regulations, 1896," to declare the following road to be a district road, *i.e.*, from Glendale Railway Station, running thence north-westerly over the Glendale sub-divisions 4, 10, Glengrey, 9 and 24, to the western boundary of the latter; thence turning northwards along the western boundaries of 24 and 37, and along a short distance of the northern boundary of the latter; thence generally north-westerly over 36, across its south-west corner, 35 and 34, across its north-east corner, the Chiweshe Native Reserve, and farm Arda, more or less along the Sawi River into farm Visa.

No. 107 of 1923.]

[9th March, 1923.

HIS Honour the Acting Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notices Nos. 567 of 1922 and 81 of 1923, and, in terms of section 17 of Government Notice No. 21 of 1917, to declare the following areas of infection and guard area in lieu thereof:—

CHARTER AND CHILIMANZI NATIVE DISTRICTS.

(a) *Areas of Infection.*

1. The Wiltshire and Worcestershire Estates.
2. The farm Swartfontein.
3. The farm Chipisa.
4. The farm Mooifontein.
5. An area within a radius of four miles of Mewuna's Kraal, in the Sabi Reserve.
6. The farm Totton.
7. The farm Rooipoort.
8. The farm Stockdale.
9. Mangeni Reserve.
10. Narira Reserve.
11. The farm Spurwing.
12. Nyamazaan.

HARTLEY, MARANDELLAS, CHARTER, CHILIMANZI AND GUTU NATIVE DISTRICTS.

(b) *Guard Area.*

An area bounded by and including the farms Palmiet Vlei, Mserenge, Glynn, Bucknall, Sunnyside, Vergenoeg, Alpha, Espy, Bow, Dean, Lilliefontein, Lovedale, Hopley's, Bita, Sabi, Goto, Kundu; thence down the Sabi River to its junction with the Rumwengi River; thence up the latter to its headwaters; thence in a south-easterly direction to the headwaters of the Nyamhonga River, and down this river to its junction with the Nyadzidza River and up the latter, the Inyazitza and Nyamatsetse Rivers to the farm Riversdale; thence by and including the farms Riversdale, Welwart, Lionsdale, Silverdale, Geluk, Shasha Fountains, Driefontein A and B, Grootfontein, Mtao, Murchison, Fairview, Hartbeestfontein, Intete, Chesa, Judaea, Umvuma Commonage, and that portion of the Central Estates lying north-east of the Umvuma-Rhodesdale road; thence along the eastern boundaries of the farms Sebakwe, Xmas and Bushy Park; and thence along the boundary of the Charter Native District to the farms first named.

No. 73 of 1923.]

[9th February, 1923.

IT is hereby notified that His Honour the Acting Administrator has been pleased, under the provisions of the "Water Ordinance, 1913," as amended by the "Water Ordinance, 1913, Amendment Ordinance, 1920," to appoint a Water Court, constituted as follows, for the purpose of hearing such applications and references as may now be, or become during the sittings of the said Court, mature for consideration and determination:—

President—Robert McIlwaine, Esquire, M.A., LL.B. (Water Court Judge).

Assessors—Arthur Cyril Jennings, Esquire, A.M.I.C.E., A.M.I.E.E. (Government Irrigation Engineer); Edward Scott, Esquire (unofficial member).

Ernest Edwin Burt, Esquire, shall be Clerk of the said Court.

No. 74.]

[9th February, 1923.

Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended from time to time.

IT is hereby notified that the following applications have been made for authority to use water :—

Name of applicant.	Farm.	Native district of	From what river.	Nature of application.	Purpose for which required.	Period for objection.
M. J. Grouws (by consent of the B.S.A. Co.)	Lesapi Peninsula	Makoni	Lesapi	To divert public water	To irrigate 80 acres	Three months
F. J. Durand (by consent of the B.S.A. Co.)	Early Mo	do.	do.	do.	To irrigate 10 acres	do.
do.	do.	do.	do.	do.	To operate a water wheel developing 12 h. p.	do.
A. M. Fleming	Stricklands	Marandellas	Shrumbwe	do.	To irrigate 250 acres	do.
H. K. Bayne	Cheveden	Victoria	Unnamed tributary of the Bivum	do.	To irrigate 50 acres	do.

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 539 of 1922, to lodge, within the period above specified from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections or other representations (if any) to the granting of these applications, together with a full statement of the grounds for such objections or representations.

Nos. 91, 106 and 112.]

Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended from time to time.

IT is hereby notified that the following applications have been made for authority to use water :—

Name of applicant.	Farm	Native district of	From what river.	Nature of application.	Purpose for which required.	Period for objection
D. W. Bean	...	Sub-division "A" of Didsbury	Mazoe	To divert public water	To irrigate 20 acres	Three months from 23-2-23
R. G. Garvin	...	The Springs do.	Makoni do.	do. To store and divert storm water	To irrigate 25 acres To irrigate 100 acres	do. do.
do.		Howick do.	do. do.	To divert public water To store and divert storm water	To irrigate 25 acres To irrigate 100 acres	do. do.
R. le S. Fischer	...	Fischer's	do.	To divert public and storm water	To irrigate 75 acres	Three months from 9-3-23
H. G. de Montmorency Prior	Ballinalhoney	Victoria	Popotekwe	To divert public water	To irrigate 100 acres	Three months from 16-3-23

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 539 of 1922, to lodge, within the period above specified from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections or other representations (if any) to the granting of these applications, together with a full statement of the grounds for such objections or representations.

NOTICE

The Agricultural Journal of Southern Rhodesia

is issued by the Department of Agriculture, and can be obtained upon application to the Editor. The Annual Subscription, which must be paid in advance, is 5/-, and payment may be made by any means other than by stamps.

Persons residing outside Southern and Northern Rhodesia and the Union of South Africa, may become subscribers by paying 4/- in addition to the subscription, to cover postage.

If payment is made by a cheque drawn on a bank outside Rhodesia, commission must be added.

All cheques and postal notes must be made payable to the Director of Agriculture.

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Date,.....19.....

To the Editor,

“Rhodesia Agricultural Journal,”  
Salisbury.

Please enrol me as a subscriber to the “Rhodesia  
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19....., for which I enclose.....

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Please write distinctly.





Committee of Enquiry in respect of the Cattle Industry of Southern Rhodesia.  
 Members : 1, Dr. Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S. (Chairman) ; 2, H. U. Moffat, Esq., M.L.C. ; 3, M. E. Cleveland, Esq. ;  
 4, O. C. Rawson, Esq. ; 5, C. S. Jobling, Esq. ; 6, Bertram Woods, Esq. (Secretary).





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[No. 3.

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## Editorial.

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*Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.*

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**Report of the Cattle Committee of Enquiry.**—An interim report of the Committee appointed to enquire into the cattle industry of Southern Rhodesia has been presented and is published in this number. The recommendations, it will be observed, fall under two heads—first, those recommending certain further enquiries, and second, a number of recommendations to Government with a view to encouraging the establishment of meat exports from this country, increasing our markets and assisting the improvement of our existing herds. No doubt the report will arouse widespread interest and discussion, and this indeed is very desirable and to be welcomed.

**Our Contents.**—This issue of the *Journal*, it will be observed, consists, contrary to our usual rule, of only a limited number of contributions, which, owing to their importance and length, have compelled us to exclude the larger variety of subjects with which we usually supply our readers. The reasons for this course lie in the urgency of the cattle question, the desirability of issuing the annual report and the statistical information for last year at the earliest moment possible, and the great interest attaching to the report on tsetse fly continued from our last issue. We have been obliged to hold over the remainder of the article on pig-rearing and several other interesting papers till our next number on account of lack of space.

**Locusts.**—In view of the prevalence of swarms of flying locusts in parts of the Transvaal and Bechuanaland, Rhodesian farmers who grow winter crops will be well advised to make preparation for the protection of their lands, as far as this is possible, by means of smoke smudges.

Materials for producing quick fires and maintaining these for some hours should be collected and kept in position around the lands, with special attention to the side towards the prevailing wind; but other sides should not be neglected. Further material, which on burning gives off a pungent smoke, should also be placed in readiness when there is reason to fear a visitation at short notice. Green wood with leaves attached will probably be the most readily available material of this description, but of course anything which can be added to render the smoke denser and more foul-smelling is an advantage. In the South African Union the following formula for a chemical smudge has been recommended:—

|                  |           |
|------------------|-----------|
| Saltpetre ... .. | 30 parts. |
| Sulphur ... ..   | 12 „      |
| Borax ... ..     | 8 „       |
| Coal tar ... ..  | 25 „      |

The saltpetre, sulphur and borax should be in fine powder or should first be ground; they should be thoroughly mixed and then added to the tar (warmed if necessary) and thoroughly incorporated therewith.

A deep tin, such as a jam or coffee tin, should be filled three-quarters full of the tar mixture, and on the top of this should be placed a layer about a quarter-inch deep of priming mixture of the following composition:—

|                                               |         |
|-----------------------------------------------|---------|
| Saltpetre, sulphur and borax mixture as above | 2 parts |
| Sugar, fine white ... ..                      | 1 part  |

In compounding this mixture it is essential that the saltpetre should be thoroughly dry; it is apt to absorb moisture from the air, and should, therefore, be dried in an oven and allowed to cool before mixing. In the centre of the priming composition a small quantity (just a pinch) of chlorate of potash (finely powdered) should be

sprinkled, as this will enable the mixture to be ignited without any trouble. A few strings of cordite or gunpowder out of a cartridge could also be used for this purpose. As soon as the priming composition is ignited a lid of some sort can be put over the tin loosely. The priming mixture should burn fiercely, and in about 30 seconds a dense smoke should be produced; an ordinary jam tin, holding 1 lb. of mixture, will burn for about 12 minutes. If the mixture starts into flame, a few handfuls of sand should be thrown over it to stifle the flames; there is no likelihood of it being extinguished when once fully ignited. It is of the utmost importance that the priming composition should be thoroughly dry.

Although it is not practicable to undertake a poisoning campaign against the flying swarms owing to the danger attending this practice, the sparsely populated condition of the country and the mobility of the swarms, farmers may adopt mechanical means if swarms happen to settle for the night in an accessible position. The most effective appear to be rollers and brush drags. A roller can be made from a straight tree trunk, such as that of a gum tree, 9 to 12 feet long, strong bolts being driven into the ends to hold the chains. The ends of the trunk should be rounded off to prevent the chains rubbing, and are best bound with wire to prevent splitting. An alternative suggestion is a number of uncut rolls of barbed wire on an iron bar. Six rolls should make a useful roller. Rollers are very effective on even ground. On uneven ground a brush drag consisting of a thorn bush weighted down with bags of sand is preferable. Rollers and drags are, of course, drawn by oxen over the infested ground with a view to crushing and injuring the insects.

Flying swarms can be poisoned with arsenite of soda solution when they settle for the night, but in the Union this is not recommended on account of the scattering of the swarms and danger to stock and natives in picking up the dead locusts.

Locusts can be collected at night time or in the early morning by shaking them off the trees into blankets, or by using a strong bag after the fashion of a butterfly net or even a bucket. They can be shot into sacks, killed with boiling water, dried in the sun and used for poultry food. Locusts will soon eat their way through a sack, so the killing must not be delayed longer than necessary.

The information given above has mostly been taken from the reports of the O.C. Locust Administration in the South African Union. Any enquiries concerning this subject should be addressed to the Chief Entomologist, Salisbury.

**Stall Feeding of Cattle.**—A series of experiments in stall feeding of cattle at the Government Experiment Farm, Gwebi, extending over a number of years, have now laid down fairly definitely the lines along which cattle may best be fattened in the circumstances there met with: the foodstuffs available, the quantities required, the time necessary and the treatment to be given. During the coming winter it has been

arranged to fatten on these ascertained lines six pens of oxen of five different grades representing Shorthorn, Hereford, Sussex, Aberdeen-Angus and Devon crosses, and one pen of grade scrubs, that is, cattle of similar breeding, but not of the form or quality generally regarded as being associated with quick and easy fattening. This feeding demonstration is experimental, but is not to be regarded as a competition as to the relative merits of the breeds concerned. Such a test cannot be any more conclusive as to the final superiority of any one breed over others than is the Thousand Guinea Trophy or the Christmas championships at Smithfield.

The pens must vary in quality according to their origin, though as far as possible fair representative lots have been selected. Some are only first cross, others are three-quarter bred. In some instances the grading has been straight—by the use of one breed only—in others the ancestry contains more than one European breed. In age and past treatment the lots also differ somewhat, making comparison not a simple affair by any means. None the less it will be interesting to observe the various crosses under identical conditions of feeding. The competitive idea is to be discounted, but the possibilities of the various beef breeds will be demonstrated.

The Shorthorn grades will be drawn, as in past years, from the Rhodes Inyanga Estates; the Sussex have been supplied by Mr. L. Glanfield, Ballineety; the Aberdeen-Angus are furnished by Mr. Duncan Black, Selby; the Devons by Mr. J. W. Palmer, Thornpark; and the Herefords come from Mr. J. O. A. Fraser Mackenzie, of the Lone Cow Estate. Thanks are due to these breeders for their willing help and public spirit.

Anyone interested in the feeding of cattle and in the possibilities of the breeds mentioned will be welcomed at the Government farm, which can be reached by car from Salisbury, twenty miles, or by trains which go out in the morning and return the same evening.

**Cattle Feeding Experiments, 1922.**—A report appeared in the *Rhodesia Agricultural Journal* for February, 1923, detailing the results of cattle feeding experiments at the Government Farm, Gwebi, in which Shorthorn and Sussex grade cattle were fed. Mr. L. Glanfield, who kindly supplied the latter, desires it to be pointed out that they were fully a year younger than the Shorthorn, though only 100 pounds less in weight, and that they put on an equal average daily increase on a smaller gross weight, despite the fact that owing to the smaller gross weight the Sussex received 10 per cent. less food per head than did the Shorthorn.

**The Citrus Fruit Industry.**—Since the editorial notice which appeared in the April issue of the *Journal* was written, the annual general meeting of the Fruit Growers' Co-operative Exchange of South

Africa, Ltd., has been held and a permanent board of directors appointed representative of citrus, deciduous and pineapple areas. The great bulk of the fruit sent overseas will be dealt with by the Exchange, which is making the necessary arrangements for shipping space. Rhodesian oranges for export overseas have been going forward since the beginning of May, and consignments will continue to be despatched until mid-October, during which period it is estimated some 60,000 cases will be sent away. Our exports of citrus fruits for 1922 totalled 19,369 cases, and for 1921 18,616 cases. It is expected that during the present season between 450,000 and 500,000 cases of citrus fruits will be exported from South Africa, including Rhodesia. New regulations governing the export of citrus fruits have recently been introduced, under which the grades have been considerably tightened up. Fruit will now be exported under the marks "Fancy" and "Choice," full particulars in regard to which are given in a circular issued by the Exchange. An additional sub-grade allows fruit which is pitted by hail, but not to such an extent as to be unsightly, and provided the fruit is otherwise equal to choice grade, to be exported. Fruit of this nature will be graded "Marked."

The shipments of citrus fruits from South Africa last season did much to remove the unfavourable impression created by earlier consignments. It is much to be desired that the high standard of quality will be maintained, and that the same care in the packing of the fruit will be manifested this season. The future of the fruit growing industry, which shows very great promise, depends entirely upon the observance of these principles, and it is well their significance should be fully realised.

**European Markets for Rhodesian Beef.**—Several enquiries and even firm offers from overseas have during the past two months been made for beef from Rhodesia of a quality which could without difficulty be provided, yet in each instance it has not been possible to do business owing to lack of facilities for getting the meat to the markets. In each instance loading the beef at Durban was involved, and at the prices offering this was not feasible owing to the expenses between the ranch and that distant port. Johannesburg is the nearest point at which stock could be slaughtered and frozen, and the loss of weight and deterioration in quality in sending cattle there and the high cost even at the present reduced railway rate have rendered business impossible. To drive stock to Messina and consign thence to Pietermaritzburg for treatment has also not been regarded as feasible. That there should be enquiries is a hopeful sign, but in spite of the bounty and in the absence of facilities we are out of European markets at the prices offering.

**Agricultural Statistics.**—The attention of farmers and all owners of live stock is directed to the new regulations published in the *Government Gazette* of 4th May, 1923, under the provisions of the *Agricul-*

tural Statistics Ordinance, 1914. The points to be noted are that the returns of all summer crops are due on 30th September, and all live stock and winter crops on 31st December in each year; these returns must be transmitted to the Director of Agriculture within fifteen days of the dates mentioned. The Department of Agriculture will, as far as possible, continue the practice of sending out forms, but persons liable for rendering returns should note that the onus is on them, and non-receipt of a form is no excuse for not sending the return by the prescribed date. It should be further noted that should an owner, occupier or manager of a farm be absent at the time when the return is required, he is responsible for seeing that someone is instructed to supply the necessary information. In such circumstances the Department of Agriculture should be notified of the change in order that the Statistician may know with whom to correspond. Forms can be obtained upon application to the Director of Agriculture. These forms are similar to those issued hitherto, except for slight alterations. Thus, returns of winter crops (wheat, etc.) are now called for at 31st December, and not at the same time as the summer-grown crops. The classification of cattle has been altered. All calves under one year are now included under one heading, and a new class, yearling oxen (tollies), has been added.

In order that the statistics compiled from these returns may be as accurate as possible and of value to the farming community, farmers are requested to exercise every care in supplying the information called for under the respective headings. It should be noted that correspondence referring to agricultural statistics is post free provided the envelope is marked clearly "Statistics—On Government Service." It is hardly necessary to call attention to the provisions of the Ordinance which ensure the confidential nature of the information supplied.

**Rhodesian Native Labour Bureau.**—In the course of his speech at the annual general meeting of the Rhodesian Native Labour Bureau held in Salisbury on the 11th April, the Chairman, Mr. D. Hawksley, stated that 32,074 alien natives had entered Southern Rhodesia during 1922; in 1921 the number was 37,037, and in 1920, 55,871. These numbers included both independent and Bureau natives. In regard to the present outlook, Mr. Hawksley said the applications for the supply of Bureau labour for the current year were so small that the Bureau had been obliged to suspend recruiting in the greater part of Northern Rhodesia and Portuguese East Africa, though in certain districts a nucleus of staff was being retained to enable recruiting to be restarted as soon as the demand warrants it. He especially drew the attention of members to the fact that it is necessary for them to make applications for the labour they require well in advance of the time they will need it. Attention was directed to the fact that the farming membership had steadily increased and now totalled 1,901. The farmers, it was shown, employ 67 per cent. of the labour recruited by the Bureau. Mr. P. H. Gresson was re-elected to the board of management to represent the farmers.

**The Tobacco Industry.**—The "Cigar and Tobacco World" for April publishes some very interesting figures relative to the imports into the United Kingdom of unmanufactured tobacco from British Possessions and Protectorates. The figures show that Nyasaland sends the greatest quantity of leaf, exports from there in 1921 amounting to 524,685 lbs. of stemmed tobacco, and 4,252,218 lbs. of unstemmed tobacco. In 1913 Nyasaland consigned to the United Kingdom 433,244 lbs. of stemmed tobacco, and 1,468,607 lbs. of unstemmed leaf. In that year 35,215 lbs. of stemmed leaf and 127,659 lbs. of unstemmed leaf were received from Southern Rhodesia. British India is now growing a considerable quantity of tobacco, and 549,393 lbs. of stemmed leaf and 865,769 lbs. of unstemmed leaf were consigned to the United Kingdom from that source in 1921. This tobacco was of the Virginia type. The most important tobacco tracts in British India lie in the provinces of Madras, Bengal, Bihar, Bombay and Burma. In the "Review of Agricultural Operations in India, 1921-22," it is stated that work at Pusa has resulted in a type which combines yield and quality, and is suitable for cigarette making. It is gaining favour among cultivators in Bihar, Madras and Burma, and seed for over 60,000 acres was issued during the year. British North Borneo sent 739,050 lbs. of tobacco to the United Kingdom in 1921, and as this was valued at £141,972, it may be presumed the type was cigar leaf. Canada in 1921 sent to the United Kingdom 2,264 lbs. of stemmed tobacco and 172,097 lbs. of unstemmed tobacco.

On the 28th February, 1923, there were in bonded warehouses in the United Kingdom 395,722,000 lbs. of unmanufactured tobacco, an increase of more than twenty million pounds over the corresponding date last year. The imports of tobacco into the United Kingdom during January and February, 1923, amounted to 42,165,539 lbs., an increase of ten million pounds over the corresponding months of last year. It is interesting to note—from another source—that in 1922 Nyasaland exported 6,330,808 lbs. of tobacco, valued at £316,540.

**Milk Records.**—As will be seen elsewhere in the list of cows entered in the Rhodesian Milk Records published in this issue, Mr. J. A. Baxter's Friesland cow "Begonia" has produced over 1,000 gallons milk and 365 lbs. butter fat in 210 days. This record seems to disprove the theory advanced by many dairymen that good cows brought from the Union and kept under Rhodesian conditions can never hope to equal their milk production achieved under conditions obtaining in the south. Some maintain that the altitude in Rhodesia has an adverse effect on milk production, but this can hardly be so, as there are cows in the Union producing 1,500 gallons in a lactation when kept by their owners at an altitude of 5,000 feet and over. However, credit is due to Mr. Baxter, who has proved that, given common-sense care and feed, a cow under Rhodesian conditions can be as heavy a producer as her sisters kept under similar conditions in the Union.

**Vale.**—Mr. J. C. de Josselin de Jong, Secretary for Agriculture in Northern Rhodesia, has retired from office on pension after many years of valued service with the Administration of that territory. Mr. de Jong frequently attended our agricultural shows, and was well known and much liked this side of the Zambesi. His many friends will join us in wishing him many years of health and every success in whatever sphere his activities may be directed into.

**Seed Supply in Rhodesia.**—In a short article published in this *Journal* for October, 1922, attention was called to the seed supply in Rhodesia. Recently a sample of seed oats from the Union was forwarded to the Rhodesia Department of Agriculture by a local firm asking for a report as to the quality and freedom from weed seeds. The sample was examined, and the grain was considered of fair quality, but one ounce weight contained the following weed seeds:—

47 seeds of *Polygonum*; common name, wild buckwheat or knot-weed.

78 seeds of *Brassica* sp.; common name, charlock.

8 seeds of *Amaranthus* sp.; common name, pigweed.

6 seeds of *Lolium temulentum* sp.; common name, darnel or drabok.

3 seeds of *Arna fatua*; common name, wild oat.

3 seeds of *Millets*.

Some of the weeds mentioned above have been introduced within the last few years, and it is to be expected that many others may be introduced from time to time. The importation of such weed seed into the Territory must be viewed with concern, for once they have taken possession of the land they soon seriously affect profitable farming. *Lolium temulentum* is harmful to stock; all the others are very difficult to eradicate when once established, and are also injurious to crops, in that, being hardier and more prolific, they rob the food and moisture. The only remedy is—Sow clean seed grain.

**Horse-sickness.**—At the suggestion of the Executive Committee of the Rhodesia Agricultural Union we invite correspondence from horse owners who have been successful in preventing uninoculated horses from getting horse-sickness, in order that the preventive measures taken may be investigated.



# A Report of the Committee of Enquiry in respect of the Cattle Industry OF SOUTHERN RHODESIA, 1923.

## GOVERNMENT NOTICE

No. 442 of 29th September, 1922.

It is hereby notified that Eric Arthur Nobbs, Esquire, Ph.D., B.Sc., F.H.A.S., Director of Agriculture (Chairman), Milton Evan Cleveland, Esquire, Charles Spearman Jobling, Esquire, Howard Unwin Moffat, Esquire, M.L.C., and Otto Christian Rawson, Esquire, have been appointed a Committee of Enquiry in respect of the cattle industry of Southern Rhodesia.

The terms of reference to the Committee of Enquiry are published in the annexure hereto.

Mr. Alfred Bertram Woods has been appointed Secretary to the Committee.

## COMMITTEE OF ENQUIRY

*In respect of the Cattle Industry of Southern Rhodesia.*

To Eric Arthur Nobbs, Esquire, Ph.D., B.Sc., F.H.A.S., Director of Agriculture, Milton Evan Cleveland, Esquire, Charles Spearman Jobling, Esquire, Howard Unwin Moffat, Esquire, M.L.C., and Otto Christian Rawson, Esquire.

Whereas it appears to me desirable that an enquiry should be held with the object of ascertaining the facts and making recommendations regarding the following matters:—

- (1) the quantity and quality of cattle available for export now and in the near future;
- (2) the markets to which the industry may look for the disposal of such surplus;
- (3) the best means of encouraging and developing export to such markets; and
- (4) generally as to the prospects of the industry and the possibilities of improving the position in regard thereto;

Now, therefore, I do nominate you, the said Eric Arthur Nobbs (Chairman), Milton Evan Cleveland, Charles Spearman Jobling, Howard Unwin Moffat and Otto Christian Rawson, to be members of a Committee for the purpose of enquiring into and reporting upon the matters aforementioned.

And I do hereby desire and request that you, or any two or more

of you, do, as soon as the same can conveniently be done, using all diligence, report to me from time to time your proceedings in writing.

And I do hereby desire and request that all officials of the Public Service, all land owners, cattle owners and those interested in the cattle industry, be assistant to you in the execution of these presents, by giving all such information as may be in their power to impart.

And I do further desire and direct that you shall have access to and examine all such official books, documents, papers and records as may afford the fullest information on the subjects of your enquiry, and that you shall have power to enquire of and concerning the premises by all other lawful ways and means whatsoever.

DRUMMOND CHAPLIN,

Administrator.

1. **Preface.**—We have the honour to submit a report on the cattle industry of Southern Rhodesia prepared in terms of Government Notice No. 442 of the 29th September, 1922, attached.

Our meetings were held at Salisbury on 8th and 9th November, and 18th, 19th and 20th December, 1922, and at Bulawayo on 16th, 17th, 18th, 19th and 20th January, and 12th, 13th, 14th, 15th and 16th March, 1923.

We have had the benefit of evidence by correspondence from some 70 witnesses, and have examined orally 27 witnesses to date. We are satisfied with the response to our published requests for information, and are grateful for the willing and valuable assistance given to us by all interested in our investigations.

The importance of the subject and the urgency of certain points impel the Committee to submit this report *ad interim*, before concluding its investigations or dealing completely with the entire subject.

The Committee fully realises that the enquiry is still incomplete and that a number of points have yet to be considered, but it is felt that certain matters brook no delay, and that the views reached upon them by the Committee ought to be submitted to Government at once.

2. **Importance of Subject.**—The members have, as a result of their enquiries, become profoundly impressed, and desire also to impress the Government, with the paramount necessity of securing at the earliest possible moment an adequate and permanent outlet for our constantly growing numbers of cattle.

The present situation is extremely critical. A most serious state of financial embarrassment of cattle owners has gradually arisen and is to-day acute, with every prospect of becoming steadily worse, and unless a prompt remedy is found there must follow the ruin of a large number of our farmers and farming companies.

The cause of our predicament is neither complex nor obscure. It is the combined outcome of propitious conditions of cattle raising, lack of facilities for marketing our supplies, and the adverse circumstances of markets abroad.

The question before us is the local one, but the same problems affect the Union of South Africa and South-West Africa, and we recognise the fundamental unity of the cattle industry of every country south of the Zambesi-Cunene line. Whether actual export takes place through Walvis, Capetown, Durban, Delagoa Bay, Beira, or north to the Congo, the indirect relief is felt by all producers. The trade is one and the same, and any economy effected or new outlet secured benefits the whole. There is, therefore, a community of interests, whether the meat is handled in the same markets, meat works and ports, or not. Until such times as adequate oversea outlets can be found, internal competition must prejudicially affect all producers, but ultimately the price of better-class cattle throughout South Africa must be fixed by the world's prices, only slightly influenced by the Rand demand.

**3. Present Conditions in Southern Rhodesia.**—The high birth-rate, small loss, improvement in quality and better methods of management now prevailing have all contributed to favour cattle-raising in Southern Rhodesia. The suitability of Southern Rhodesia as a cattle country is fully established by ascertained data, and is supported by the views of experienced cattle men from other parts of the world, furnished to this Committee.

There is no reason to suppose that our present remarkable rate of increase will not continue, happily accompanied by rapid improvement in quality. Statistics show that our cattle have been doubling in numbers approximately every six years, whilst at a moderate estimate there is room within the boundaries of Southern Rhodesia for a matter of ten million head. The prospects for the future are, therefore, in this respect bright, provided a market can be found.

That the presence of an excess of mature cattle has comparatively recently arisen and has not been more severely felt hitherto is due to several causes. Firstly, many ranches are still in the stage of stocking up and have not yet seriously entered the markets. Breeding stock was first bought and their earliest progeny is only now maturing. The industry is still young and returns have not yet been expected. New settlers, large and small, have been drawing on the available stocks for draught and breeding purposes. The increase has been so rapid that the facts of the position have generally not yet been realised or foreseen. The native owns nearly half the cattle in the country, and this reservoir, when not tapped by attractive prices or drawn upon through need of money for food in times of scarcity, is allowed to accumulate, for the native regards cattle as in themselves a desirable possession, and is not inclined to sell them, especially at an early age. Finally, the country as a whole is still understocked, containing only, it is estimated, one-fifth of the total it is capable of supporting, so that there is no shortage of pasture. But for the past two years the effect of the glut and the lack of markets has become more and more severely felt, and the position is now acutely critical.

The Committee is of opinion that the cattle industry will not continue indefinitely in its present depressed condition, but must sooner or later again afford a fair margin of profit to those engaged in it. This

will be achieved through the establishment of a frozen meat industry for export overseas and to some extent by the development of our inland markets. This hopeful view is based upon direct evidence from the best informed sources overseas, hence preparation for restoration to normal conditions seems warranted. Since it must in any event take some considerable time for a meat freezing works to be built and equipped and the essential storage and shipping facilities to be provided, there is every reason why the Government should take immediate steps to that end forthwith.

**4. Present Markets.**—As regards markets, it must be admitted that the present position of Rhodesia is bad. To quote from a very high authority on the world's meat trade:—"With regard to markets, Rhodesia is in the same position as other cattle-rearing countries; the supply is in excess of the demand, but Rhodesia is further handicapped by the fact that most of her cattle are unfit for the overseas trade, and cannot enter into competition on the English markets with meat from the Argentine." Even this unfavourable opinion, however, tacitly recognises that already some of our stock could compete with Argentine meat even on the English market. The difficulty in which we find ourselves is also felt by all other meat-producing countries owing to the disturbed economic conditions of Europe, a state of affairs which may surely be regarded as transient. Other countries, however, possess meat works which even if temporarily closed down are ready to start up again the moment the market warrants it, whereas Rhodesia cannot avail herself of any improvement in the demand until the requisite factories have been built. The markets at present open are to be found in the Union, the Congo, Northern Rhodesia, Mozambique Company's Territory, Nyasaland, and within Southern Rhodesia itself. These markets, though limited, are capable of expansion, and must therefore be fostered even though they cannot themselves entirely relieve the present situation. It does not appear that a freezing works could advantageously be conducted to supply only the needs of Southern Rhodesia, Congo Belge and the Rand, yet these inland markets might, the Committee thinks, form valuable adjuncts to an overseas trade in frozen beef.

The present markets may be approximately assessed as under:—

|                                                      | Head<br>per annum. |
|------------------------------------------------------|--------------------|
| (a) Within Southern Rhodesia, slaughter stock ... .. | 90,000             |
| (b) To the Union, slaughter stock ... ..             | 15,000             |
| (c) To the Congo, slaughter stock ... ..             | 3,000              |
| "      breeding stock ... ..                         | 500                |
| (d) To Northern Rhodesia ... ..                      | —                  |
| (e) To Mozambique Company's Territory, mixed ...     | 1,000              |
| (f) To Nyasaland ... ..                              | —                  |

(a) *Southern Rhodesia.*—The present consumption within Southern Rhodesia, including all channels, appears to be about 90,000 head per annum, and the Committee sees no reason to anticipate that it will exceed 100,000 for some time to come. During 1922 the Canning Factory dealt with 3,826 head, but this should properly be taken into

account with exports, since little or none of the product was consumed within the country.

(b) *Union of South Africa*.—Since 1916, when it first commenced, the export of cattle from Southern Rhodesia to the Union has been as under:—

| Year.                | Total.  | Slaughter. | Breeding. |
|----------------------|---------|------------|-----------|
| 1916 ... ..          | 12,722  | 12,722     | Nil       |
| 1917 ... ..          | 13,221  | 13,180     | 41        |
| 1918 ... ..          | 12,153  | 12,134     | 19        |
| 1919 ... ..          | 27,520  | 22,735     | 4,785     |
| 1920 ... ..          | 30,284  | 22,822     | 7,462     |
| 1921 ... ..          | 12,637  | 7,673      | 4,964     |
| 1922 ... ..          | 18,352  | 15,716     | 2,636     |
| Grand total ... ..   | 126,889 | 106,982    | 19,907    |
| Average over 7 years | 18,127  | 15,283     | 2,844     |

With increasing supplies nearer to the Rand, which is the chief centre of consumption, the demand for cattle from Southern Rhodesia is more likely to diminish than to increase. Rhodesia, with its long haul and consequent heavy railage charges to the Rand, must always be automatically at a disadvantage as compared to places nearer that market, which cannot therefore be regarded as a permanent or reliable one. Rhodesian cattle have proved a great boon to the southern markets when droughts have afflicted the Union, which is not, however, always the case. The Union market has directly affected cattle only within ready range of Bulawayo and Messina, the numbers drawn from farther north being relatively unimportant.

The fact that supplies to the Rand from places nearer than Rhodesia are increasing makes that market probably a diminishing one, and one which may even cease, throwing the stock on to our own markets again, and increasing thereby the supplies available to our freezing works. This result may be anticipated through the normal working of economic laws, quite apart from the influence of political agitation. The Rand market, since it was first opened in 1916, has proved a great boon to Rhodesia, but our surplus is now so great that this outlet no longer suffices, nor can it be regarded as but a slight palliative of our difficulty.

The movement of breeding stock, even from a country so under-stocked as Southern Rhodesia still is, should not be discouraged in the

general interests of freedom of trade, and in view of the fact that it consists only of native cattle suitable for the foundation of ranching herds. Export of breeding stock to the Union, recently suspended, has not in the past been of much consequence, although any curtailment of our outlets is to be regretted. The prohibition, it is understood, does not apply to high-class stud stock nor to animals sent to agricultural shows.

(c) *The Congo*.—The Katanga requires at present about 12,000 head of slaughter oxen annually, of which Southern Rhodesia can only expect to provide a portion, the remainder coming from Northern Rhodesia and Ngamiland. A small demand exists also for dairy cows and other breeding stock, of which there are only about 4,000 in the Province at present. The Congo Belge appears anxious to encourage the traffic in cattle from Southern Rhodesia, but owing to the restrictions imposed by Northern Rhodesia this trade has hitherto been limited. Export of cattle to the Congo was only initiated in 1922, when during four-and-a-half months the following numbers were sent up:—

|                         |       |
|-------------------------|-------|
| Slaughter stock ... ..  | 1,693 |
| Cows and heifers ... .. | 259   |
| <hr/>                   |       |
| Total ... ..            | 1,952 |

The passage of cattle in transit through Northern Rhodesia to the Congo is only permitted by the Government of Northern Rhodesia for six months of the year—from 1st July to 31st December—ostensibly on veterinary grounds.

The Committee most strongly enters a protest on behalf of the cattle industry of Southern Rhodesia against the present repressive regulations prohibiting the transit of cattle through Northern Rhodesia during part of the year and placing most irksome and detrimental conditions upon their transit during the remainder of the year, and urges on the Government the desirability of making very serious representations to Northern Rhodesia on this subject, with a view to prompt rectification of these grievances and removal of the grounds of resentment. After Northern Rhodesian supplies are exhausted, there remains an unsatisfied need in the Katanga under present conditions for 4,000 to 6,000 head of cattle annually, most of which is for compound use. To this may be added, according to latest advices, a considerable temporary increase, owing to the extension of the railway now being built from Bukama railhead to Ilebo, on the Kasai River, employing several thousand natives who must receive meat. This railway will in turn open up the Kasai Province and a number of mining centres, which can with better advantage draw their meat supplies from Northern and Southern Rhodesia than from any other sources.

The Congo market for cattle appears to be the only inland one susceptible of further development, and that to a limited extent. Northern Rhodesia must always possess a great advantage in its proximity to this market, and Southern Rhodesia can only expect to participate in supplies beyond the power of Northern Rhodesia to provide.

Facilities were given for cattle from Ngamiland to traverse Northern Rhodesia on foot and to be railed from Livingstone for two seasons before passage in trucks was permitted to cattle from Southern Rhodesia, and in this way a small trade has been established which suffers from the disadvantages of great distance and the primitive character of the cattle. The hampering restrictions of Northern Rhodesia to the transit of live stock, the length and unavoidable hardships of the journey, and the much greater weight and larger number of trucks required for hauling animals compared to meat, alike point to the advantage of sending meat instead of live stock to the Belgian Congo.

From information received with regard to the export of cattle to the Congo last year, the Committee recommends inspection of all cattle exported by rail from Southern Rhodesia to the Congo, Portuguese East Africa and the Union of South Africa by veterinary officers, who should be empowered to prevent the despatch of such animals as are not in their opinion fit to stand the journey without undue deterioration or cruelty.

(d) *Northern Rhodesia*.—Export to Northern Rhodesia is only in its initial stages, and is limited to a few head of breeding stock. Here again extreme and inhibitory quarantine restriction imposed by Northern Rhodesia has militated against establishment of a trade which would be a mutual advantage.

(e) *Portuguese East Africa*.—Portuguese East Africa has taken each year for some time past about one thousand head of trek oxen, slaughter stock, cows and bulls, but the Committee is officially advised that the territory is in a position now to meet most, if not quite all, of its own requirements.

(f) *Nyasaland*.—Nyasaland, now connected by railway, is likely to require stud cattle only, and perhaps some foundation stock when the present farming depression is over. The Government offers no difficulties to such trade beyond reasonable veterinary precautions.

**5. Possible Future Markets.**—The influences which have resulted in the present slump in the world's prices of meat are all attributable to economic conditions resulting from the Great War. Prices of slaughter stock rose phenomenally during that time, and consequently breeding stock became dear. Rhodesia only commenced an export trade in cattle in 1916, mainly to the Union, which at that time was exporting heavily to Europe. With the stoppage of this overseas export in 1920, there was immediately a surplus both in the Union and Southern Rhodesia, which has since been increasing and accumulating from year to year. Direct export overseas from Rhodesia has hitherto been impossible for lack of facilities, although a few trial shipments to Smithfield and the Continent from Rhodesia, *via* Johannesburg, have taken place.

The price in Europe has fallen owing to lack of purchasing power, accentuated by exchange difficulties, political uncertainty and economic unrest, by competition between the great meat-producing countries of America and Australasia, and by the unfortunate reputation of South African beef, now in process of correction. These conditions still

obtain, but cannot continue indefinitely, and the Committee feels that necessary steps should be taken in Southern Rhodesia to meet the time when the markets will be open again and overseas trade in meat can be inaugurated from this country. In the meantime, even under the present conditions, there is a certain amount of trade to be done with Europe. Much has been done to foster the cattle industry of Southern Rhodesia, but the immediate and most pressing need of the country is the provision of markets for the surplus cattle which have accumulated during the past few years, and for the annual surplus now being produced.

(a) *Meat Works.*—The Committee is, after careful consideration, convinced that the solution of the overseas export problem lies in the establishment of meat works at one or more centres in Southern Rhodesia and the conveyance of the frozen meat and other products thence to cold storages at the coast for shipment. There is no insuperable obstacle to such procedure.

(b) *Boiling-down Works.*—The consensus of evidence submitted by butchers and cattle dealers agrees that the bulk of our available slaughter cattle are unfit for export overseas. Much, fortunately, can be consumed within South Africa, but there remain large numbers for which no sale whatever exists. The only possible way of utilising these cattle is by boiling down for tallow and fertilisers, and perhaps also for extract. This is preferable to the loss at present being incurred in herding and dipping unsaleable stock, and, even if not profitable in itself, would be helpful for that reason. These remarks refer particularly to the lowest classes of stock, for which any price is better than none, and which it is essential to get rid of to make way for improved stock and to harden prices. Any meat freezing works and canning works should include boiling-down on a greater relative scale than is usual perhaps in other countries. The larger ranching concerns might also well join together for the purpose of erecting boiling-down plants at suitable centres, perhaps turning to account for this purpose the existing factory at Odzi, which includes canning and boiling-down plant, with all the necessary adjuncts. From evidence received by the Committee, it appears that a small boiling-down plant capable of dealing with ten to fifteen head of cattle per day could be erected for about £900. The working costs of such a plant were quoted as being about £1,200 per annum, which includes depreciation and 6 per cent. interest on capital. The working costs of this treatment on the basis of 3,000 head per annum were estimated to be in the neighbourhood of 8s. per head.

(c) *Native Rations.*—The Committee, supported by generally favourable views of witnesses representative of the mining and medical opinion, recommends that the present scale of diet to natives engaged on mines, railways and other employment where a ration is given, shall be altered by giving one pound of fresh meat in lieu of two pounds of beans at present provided on the ration schedule. It has been given in evidence by high medical authority that dietetically this would be an improvement, and that it would be satisfactory on that account. Beans are frequently unprocurable. The cost would not be greater,



and in many cases less, and we are assured that the natives would greatly prefer it. This step increases by one-half the present meat ration, and would affect to-day about 40,000 boys, utilising annually about 5,000 more cattle of a class also which would not trench upon the supplies suitable for export.

(d) *Minor Overseas Markets.*—The Committee has learnt that importation of frozen beef and live cattle to Egypt and to Mauritius exists, and in view of the position of Southern Rhodesia, it appears that this country might reasonably participate in the trade. Mauritius, in 1921, imported 17,596 head of live cattle, of which 4,492 were for draught purposes and the rest for slaughter.

To find markets overseas is usually the duty of a trades' commissioner, not yet existent, and as the need of markets for our cattle is so urgent, it is recommended that special delegates be sent to make enquiries in those cases where it appears to the Committee there is reason to believe markets may be developed in the immediate future. The Committee feels that much may be achieved by direct personal enquiry on the spot by persons familiar with our circumstances, and that the cost involved would be amply justified.

Delegates sent to Mauritius and Egypt would enquire into the supplies of meat and cattle sent there from other countries, their class, weight and origin, the means of shipment, prices, the prospects for increase of trade and for supply from this country. If necessary, the trade might be traced back to the countries of origin, and particulars ascertained as to breeding, raising, despatch of stock, loading and values there.

(e) *Canning Factory.*—In the canned meat trade there appears little prospect of profitable overseas markets at the present time, but it ought not to be impossible to compete within South Africa successfully against foreign manufactures, if the price of canners in the first instance is sufficiently low and management sound. This view is expressed after consideration of the circumstances surrounding the recent voluntary liquidation of the Odzi Canning Factory.

The unfortunate results of the operation of the Canning Factory are not to be regarded as a criterion, as its circumstances were altogether exceptional. It would appear that if 20s. to 25s. per head had been given for the stock, which was about the world's price for canners, the factory would not have incurred a loss in its last run, and might have sold its product in competition with the Australian article. True, that price is very low indeed, but it is better than no price at all.

**6. Recent Developments Elsewhere.**—As showing that other countries are alive to the necessity for action in this direction, we may mention the opening of two new meat works in Australia, and the decision to establish works costing about £250,000 at Walvis Bay, South-West Africa, in the early future.

**7. Government Encouragement.**—(a) *State Aid.*—We conceive it to be the duty of the Government to provide facilities for the dis-

posal of the products of the country without necessarily embarking itself upon manufacturing industries on behalf of any section of the producers, or financing such undertakings. To secure outlets for our cattle the Government would be fully warranted in expending any sums necessary, which, even if large, would be trivial compared to the value of the markets when found.

Under present depressed conditions no firm competent to deal with the subject can be expected to establish meat works and a meat export trade in Rhodesia without very special inducements and assurances from Government. Such an enterprise involves large capital investments in plant and buildings, and only those already well established in the same trade elsewhere are really in a position to embark upon such a great undertaking in a new country, and in the face of existing interests, connections and competition elsewhere. The solution of the cattle problem would stimulate many other branches of trade and favourably affect our national credit. For these reasons, Government, in the opinion of the Committee, is justified in offering very special attractions to suitable firms to enter this new field.

Although the volume of the business and quality and price of the stock must themselves form the basis on which are to be calculated the possibilities of meat works in Southern Rhodesia, yet other attractions may also be taken into consideration, and the Committee recommends that every possible inducement within its power should be given by the Government, by public bodies and by stock owners to secure the establishment of meat works at the earliest possible moment.

(b) *Land and Water.*—Where possible, free grants of sites for factories, employees' houses, depôts and grazing areas for collecting stock should be provided by Government or municipalities; also special facilities in regard to water, light, roads, and access, and exemption from rates. In this connection it may be mentioned that in America cities outvie each other in offering such advantages, and even give cash subsidies for industries to be started in their midst.

(c) *Fiscal Inducements.*—Valuable help might be given by Government through remission of income tax on the profits up till the end of (say) 1935 of any works directly engaged in the meat export trade, that is, in the killing of cattle and treating and exporting the products in so far as export trade is concerned. Profits on internal trade in competition with local butchers and tradesmen would be subject to tax. The State could also grant exemption from Customs dues on all machinery, plant, accessories and supplies, including tinsplate, salt and so on, for the like period, and on the same basis.

(d) *Exclusive Rights.*—If, amongst inducements offered, are included exclusive rights to export frozen and chilled beef, it is possible the objection will be raised that this amounts to a monopoly. After consideration the Committee, whilst recognising the obvious objections to the granting of such privileges, has come to the conclusion that, in the circumstances, it would be to the benefit of the country, and that, since the exporter is dependent for his supplies on the prime producer, it is manifestly in his interest to maintain prices at a figure which will

keep the works in full operation without fluctuation throughout the year, and from year to year. Such is the experience of other countries, and there is no reason to doubt that the same would hold here. Some assurance of this sort, limited to a definite period and to oversea export only, is therefore proper, and may be held out as an inducement to capital to come to Rhodesia for the purpose of opening up a new industry and as a protection against competitors profiting by the experience of the pioneers, at any rate for a certain number of years. The first firm effectively to commence this trade would, it is to be remembered, virtually establish a monopoly in any case, since it must be some time before there is any possibility of two such concerns operating profitably. Therefore they would only be getting an assurance from Government of what they can virtually secure for themselves—a long start against competition—for of course the exclusive rights would be for a certain time only. Any monopoly in respect of overseas export would still leave local, Congo and Rand markets unaffected. It would only be partial, and therefore at once deprived of the objections of a true or complete monopoly.

(e) *Financial Guarantees.*—The Committee suggests that, failing any other solution, the Government might go so far as to guarantee for a term of years the interest on capital invested in meat works by any company. If the above-mentioned concessions are not sufficiently attractive to induce companies to embark upon the undertaking, the Committee realises that the Government would be faced with the necessity of itself erecting such works to prevent the ruin of our cattle industry and all which that implies.

(f) *Bounties.*—Apart from reasons which actuated the Union and Rhodesia recently in following the Australian lead in the matter of bounties to tide over the present depression, it may be expedient to grant a bonus on export in order to secure the establishment of a meat works in Rhodesia. Such assistance might be regarded as an alternative to other inducements or privileges, and be given for the first few years only.

(g) *Port Facilities.*—In view of the possibility that Beira might become the shipping point for meat treated in Southern Rhodesia, it is suggested that the Administration of the Territory approach that of the Mozambique Company to ascertain what attractions the latter might be disposed to hold out to secure this advantage to the port, and to arrange that these may be embodied in an agreement.

(h) *Railway Rates.*—Assurance as to cost of conveyance of meat from the works to the coast and of live cattle to the works for a prolonged period would also, it is considered, enable such works to calculate reliably their expenses, and even though the railways here are privately owned, there is reason to believe that, with the good offices of the Government, satisfactory assurances on this point could readily be secured.

(i) *Ocean Freights.*—Similarly, the Government might add its weight to negotiations with regard to shipping rates.

(j) *Legislation.*—In anticipation of probable erection of meat works,

it is highly desirable that legislation controlling their management should be passed at an early date, in order that persons interested may know the conditions under which they would operate, no doubt on the lines of similar legislation in other meat-exporting countries. The Government should further give assurance of no vital change in principle for a certain period, to allow of the organisation of trade, with reasonable security as to continuance of economic conditions relating to such matters.

**8. The Cattle Available.**—The Committee recognises that the precise numbers of cattle suitable for slaughter at any moment in the country cannot be arrived at with exactitude. This figure must vary with the season, the requirements of the country for draught animals, the fluctuations of present markets, and the inclination of natives to sell, which varies from year to year. The present number of cattle in Southern Rhodesia for the purpose of this enquiry may be taken at two millions, rather over half being European-owned. The average rate of increase over the past eight years is 12.3 per cent. The country being under-stocked results in the retention of most cows for breeding purposes longer than would otherwise be the case. The present available surplus of our stock is to be calculated on the natural increase five years previously, with allowances for mortality, not on the current year's figures. The figures in the following table have been derived from statistics officially collected from the stock owners of the country:—

STATEMENT OF NUMBERS OF CATTLE IN SOUTHERN RHODESIA, SHOWING YEARLY NET INCREASES AND INCREMENT FIVE YEARS LATER.

| Year.             | Total number of cattle. | Increase over previous year. | Number five years later.                      |
|-------------------|-------------------------|------------------------------|-----------------------------------------------|
| 1st January, 1916 | 840,916                 | 92,858                       | 69,643 (1921)                                 |
| 1917              | 960,026                 | 119,110                      | 89,333 (1922)                                 |
| 1918              | 1,083,943               | 123,917                      | 92,938 (1923)                                 |
| 1919              | 1,210,547               | 126,604                      | 94,953 (1924)                                 |
| 1920              | 1,331,284               | 120,737                      | 90,553 (1925)                                 |
| 1921              | 1,517,291               | 186,007                      | 139,507 (1926)                                |
| 1922              | 1,754,144               | 236,853                      | 177,640 (1927)                                |
| 1923              | ...                     | ...                          | * Increase of past three years = 251,914 head |

The number five years later is taken after allowing for export and local consumption and a mortality of 5 per cent. per annum. The

increase recorded for each year is, therefore, a net and not a gross one. From the above figures it will be seen that the increase for the three years 1921-2-3 approximates 250,000 head of all kinds and both sexes. Owing to lack of markets, a large surplus has thus accumulated, apart from the ordinary annual increase. The larger portion of this mature stock is available for slaughter, but a certain amount is needed for the development of the country in regard to breeding and draught requirements. The accumulated surplus will be available, but must dwindle and disappear. The normal annual increase, however, is steadily becoming larger. When a ready market is available, these two circumstances should operate to provide a steady supply for the future.

In connection with these figures, it is to be emphasised that much of our stock of good quality is not finished off in perfection, for lack of demand for high-class prime fat beef, and that in many instances systematic improvement has commenced so lately that second or third-cross calves are only now appearing. It is obvious to all familiar with the cattle of this country that a very rapid improvement is taking place, the benefits of which are only now beginning to be apparent in our markets.

**9. The Value of Cattle.**—An exaggerated idea of the commercial value of cattle unfortunately exists in the minds alike of European and native stock owners, and, however unpalatable, it is necessary that this should be realised and corrected. The view is taken that the market price of our beef must in the long run be fixed by the world's market prices rather than by the somewhat peculiar local conditions influencing the nearer markets of the Rand and Congo, and certainly cannot be maintained at the level paid for breeding stock in past years. The lowest class of stock, scrubs and culls, must be sold at any price that can be got for them, however low.

**10. Quality of Cattle.**—The Committee is satisfied, from reliable and authoritative evidence, that the quality of beef required even by Smithfield can be raised in Rhodesia in quantity. A fundamental fact to be determined is the proportion of our slaughter cattle which may be regarded as suitable for the export trade in frozen form. A number of witnesses with knowledge of the subject showed remarkable agreement in placing this figure at about one-quarter of the European-owned slaughter stock, and this the Committee is inclined to accept as probably near the mark. Whilst it is quite possible that quantities of cattle suitable for freezing may be available during the next few years, it is doubtful if any large number of the class suitable for chilling will be obtainable for some time to come, and any such may well be included with freezers to enhance the average merit of that grade. The Committee realises that whilst a certain proportion of our stock is of a quality fit possibly for the markets in England, yet the preponderance of our exportable meat for some time to come will be of the class known as suitable for continental markets. The further problem of the disposal of the remainder of our surplus through inland markets, local treatment and certain minor overseas markets, necessitates further investigations before final opinions in regard to them can be given. Other outlets than those of Europe must also be sought. So

great and rapid is the improvement that before even a factory can be in operation or before Europe can again import freely the number and quality of our cattle will have altered for the better.

The European-owned cattle in Southern Rhodesia to-day have mainly been derived from the local native stock by grading up with bulls of European breeds, for the greater part with a view to beef production, and are not derived from a long succession of stock raised for draught and dairy purposes or with hardiness as the chief desideratum. These cattle, so far as form, flesh and fat are concerned, are therefore of a good type, whilst it is to be recollected that very heavy weight is no longer the desideratum it once was in England.

The Committee has received definite information that there is a market in Europe for cattle of good conformation in prime condition and weighing not less than 540 pounds dressed, and that a certain demand also exists for similar animals down even to as low a weight as 480 pounds. The proportion of Rhodesian cattle that would satisfy the latter category is, of course, much higher than the former, and, apart from size, such cattle are of excellent quality.

At the same time the continental market appears to attach importance to weight; thus an instance has been quoted to the Committee where the price per pound was reduced by  $\frac{1}{4}$ d. for quarters averaging 125 pounds, which means a 500 pound carcase, as against quarters averaging 140 pounds, which means a 560 pound carcase, of otherwise precisely the same class. The added price is a strong inducement to farmers to bring up the weights to the higher average, and this could in many instances be done by feeding. An increasing proportion of the cattle of Southern Rhodesia to-day is of an improved type, and there seems no reason why the remainder should not also be graded up in the course of time.

Evidence, with which the Committee agrees, shows that under a proper system of management better bred stock will thrive on our ordinary veld. In this term is included the provision of fenced areas and proper water supplies, so that the grazing of paddocks in rotation may be practised. The limit of improvement has not yet been reached, but the best grade stock we to-day have thrive well and fatten on our veld. The country is to-day in the difficult transition stage when the unimproved foundation stock is still with us, though rapidly giving place to the improved grades.

The Committee would impress upon the Government and the farmers of the country the paramount importance of improvement of quality, as it is only cattle superior to the average at present produced which will be readily saleable in the European markets. To this end it is imperative to the cattle industry to do everything to improve the average quality of our stock.

Recognising this principle, the Committee regards as the first step thereto an assurance of markets, and emphasises the necessity for the Government to spare no efforts to secure outlets by acting on recommendations submitted in this report. The assurance of a market would at once act as an enormous incentive to the improvement of quality.

Superior beef is more profitable to export; on the other hand, failure to improve divests us of all hope of establishing a market.

**11. Erection of Meat Works.**—The freezing and export of beef and the manufacture of the many by-products is a specialised business demanding the attention of those already experienced and skilled therein, whilst disposal in the world's markets is a matter also requiring intimate knowledge and commercial abilities, such as are associated with established firms already engaged in this industry. In the opinion of the Committee the treatment and export of our cattle should be made the direct business of a reputable firm already established in the trade, and the cattle owners, by themselves, should not be expected to erect and conduct freezing works in the country. If such a concern were to provide capital and extend its operations to Southern Rhodesia, it is reasonable to anticipate that the larger ranching and land companies and the general public would be prepared to participate in an enterprise which must have such a very great influence on their prosperity. Support from Government should take other forms than shares, whilst the capital of the farmers is, even from the point of view of the meat factory itself, better expended on the development of the land and improvement of the stock.

The readiest solution of our difficulties, and one which has the precedent and countenance of recent adoption in a neighbouring State very similarly situated, seems to lie along the lines followed in South-West Africa. The terms of the agreement between the Union Government and the Imperial Cold Storage Company are public property. In many, though not in all, particulars the problems before South-West Africa and Southern Rhodesia are much alike. In the opinion of this Committee the position of Southern Rhodesia as regards numbers, natural conditions and prospects of expansion, is much more favourable than that of South-West Africa, but we have no sheep, and no port of our own. The adoption of some such course as has been followed there is recommended, and the Committee would urge the Government to lose no time before issuing a world-wide advertisement for tenders and inviting competent capitalists to embark upon the enterprise. All other recommendations of this Committee are subordinate to the first necessity, the provision of a meat works, termed in other countries packing houses or frigorificos. What the precise conditions and attractions to be offered are is a matter for the Government of the day to decide. It is at once apparent that having no sea-board, inducements in regard to port facilities given in the case of Walvis Bay cannot be offered by us, but as it is very much to the advantage of the port to have the in-transit trade resultant from meat export, this would appear to be a matter presenting no great difficulty of adjustment with any of the Governments controlling the harbours concerned—Beira, Lourenço Marques or Union ports. The same consideration adds weight to the arguments in favour of an inland meat works as against one at the coast.

**12. Invitation to Meat Packers.**—The Committee feels that no adequate idea of the condition of our herds as regards their quality and degree of improvement can be conveyed to prospective packers

without personal inspection and verification. It, therefore, earnestly puts forward the recommendation that the Government invite certain leading firms engaged in the meat industry to send representatives to Rhodesia to be separately conducted over the country to examine conditions on the spot for themselves and inspect our cattle, our veld, our markets and potential factory sites, and particularly to visit a number of typical ranches and satisfy themselves as to the class of stock and the proportion suitable for export. Other aspects of the subject can largely be ascertained from figures and information supplied, but the suitability as freezers of an adequate proportion of our slaughter stock must be determined by examination by competent judges on behalf of those interested in the export trade. At the same time no doubt other matters relating to conditions affecting the business could be studied on the spot. Such tours in the country should occupy about two months, and all expenses out and back (other than fees or salaries) should be defrayed by the Government. It is believed that only firms likely seriously to consider establishment of works would accept such an invitation, which would enable them to form accurate and independent opinions as to the possibilities of the country. The expense involved is trifling compared to the advantages to be gained if one or more firms established in the business can by ocular proof be convinced of the merits of the proposition. Such tours should be arranged, if possible, before July of the present year.

The Committee calls attention to an announcement in the Press that the South African Trade Association is prepared to devote £5,000 to the investigation of problems connected with the cattle industry, and proposes that experts be sent out to ascertain whether there are sufficient cattle in South Africa to permit of an adequate export trade, and to ascertain whether the scheme could be executed on a commercial scale and compete successfully with the existing sources of supply. It is recommended that the Government immediately place itself in communication with this body, with a view to assisting these enquiries in every possible way, and ensuring that the interests of Southern Rhodesia shall be adequately brought before the expert visitors.

**13. Situation of Meat Works.**—The sites for meat works and cold storages, the port to be used and the provision of the necessary rolling stock are technical matters for the consideration of those embarking in the business, but so far as the Committee has been able to gather, the system outlined above offers no great difficulties, and possesses many advantages over the alternative of conveying live cattle to the coast or to distant inland centres in the Union for treatment. In this connection it is to be recollected that there are great advantages in favour of treating the animals as near to their grazing grounds as possible, avoiding loss in weight and grade and in fevered and bruised conditions of the meat. It is sometimes claimed that meat works ought to be at the coast. This is not so, except where conditions are favourable for conveyance of stock alive to the port. Beyond a certain zone the advantages of killing near the grazing ground outweigh those of treatment at the coast, and this is the case with Southern Rhodesia and the inland portions of the Union. As the cattle-raising industry has advanced farther into the interior, it has been



found in other countries advantageous to erect works in inland centres to which the cattle can be brought on foot or by rail, thus avoiding the long haulages which have been found to be detrimental and more expensive than treatment near the ranches and conveyance to cold store depôts at the ports. The more recently erected works are inland, and numerous cases may be cited in Australia, the Argentine, Brazil and the United States, and even in South Africa, in Johannesburg, Maritzburg and Harrismith.

The attitude of the Liebig Extract of Meat Company has been much discussed by the public interested, and it may be well to state that the Committee has been informed by the Managing Director, Mr. C. E. Gunther, as follows:—"With regard to the establishment, by my company, of markets for the cattle of Rhodesia, the position now is as it was ten years ago. Owing to the absence of suitable railway communication with a sea-port it is not possible for us to establish a factory for meat products." (2nd January, 1923.)

Meat works on our southern border would, of course, utilise cattle from the adjoining countries, the Transvaal and Bechuanaland, as well.

**14. Ports.**—Durban and Delagoa Bay, where meat loading facilities exist, are equally remote from Rhodesia, though the latter port would be brought sensibly nearer by building a line from West Nicholson to Messina. Beira, which is much the nearest point on the coast, possesses no cold storages from which meat could be shipped, but presents no serious difficulties in regard to sites for erection of these, whilst loading beef by lighters, which would be necessary, is successfully carried on in various parts of the world. An incidental advantage to the country at large and to any cold storage concern at Beira lies in the opportunity such stores would give for the export of butter, bacon and oranges.

**15. Enquiries in the Union of South Africa.**—In order to complete in certain directions the instructions of our terms of reference, it is recommended that representatives of this Committee should proceed to the Union to conduct a variety of enquiries indicated below, which in its opinion cannot be adequately dealt with by other means. The information furnished to the Committee gives sufficient grounds for the belief that these further investigations would be productive of information which would enable it to give more authoritative advice to the Government and to speak with greater competence on certain aspects of the subject than it at present feels able to do.

The Committee is in entire agreement with the principle that in all matters appertaining to the export of cattle overseas the interests of the Union and of Rhodesia are identical. Until such time as meat works are established in Rhodesia, export through the Union is essential, and even then it is recognised as highly desirable that the closest connection should continue, as the interests of the two territories are in this matter so intimately associated. An important object of these proposed enquiries in the Union is to ensure organisation of the industry on these lines at the earliest possible date.

The sub-committee visiting the Union would give attention to the following points:—

- (1) The prospects of meat export from the Union.
- (2) The best methods of co-operation of all concerned in meat export from South Africa and the basis of agreement for exporting conjointly to the same markets cattle from the Union and Southern Rhodesia.
- (3) Present and prospective prices of beef.
- (4) Inspection of exports.
- (5) The quality, appearance, form, finish, dressing and price of beef for overseas markets.
- (6) The recent agreement in respect of erection of meat works in South-West Africa.
- (7) Existing meat works, cold storages, abattoirs and port facilities.
- (8) Regulations governing the control of meat works in respect of meat inspection, hygiene and cleanliness.

The enquiries involve personal interviews with Government officials, municipal and port authorities, and the representatives of meat works, cold storage abattoirs, shipping firms and co-operative societies. The information desired would be collected at Johannesburg, Pretoria, Lourenço Marques, Durban, Maritzburg, East London, Capetown, Bloemfontein and Harrismith.

**16. Enquiries in Madagascar.**—Information has been collected through the Imperial Institute, London, and from other sources in regard to the cattle industry of the island of Madagascar, from which it appears that there is much analogous with our conditions, but that in certain directions, notably as regards export of live stock and frozen meat, in the possession of ten factories, and long established export trade to Europe and elsewhere, this French colony is considerably in advance of Rhodesia. She possesses, it is true, larger numbers of cattle, but they are reputed to be native stock, little if at all improved, and smaller in size than ours.

The ports of Madagascar are very near to Beira, so that the ocean distance and the route to Europe are the same. The island lies in the same latitude as Southern Rhodesia, and is described as in parts being not dissimilar.

The meat export business is not so highly developed as in America or Australia, but would nevertheless be instructive to us. It would be interesting to Rhodesian stock owners to ascertain how the successful development of the meat export trade of Madagascar has been achieved, and the conditions governing it which might be applied to this country. To this end the Committee is of opinion that a report should be specially obtained by personal enquiry on the spot, and that the Government should immediately send a reliable representative to study conditions there, and procure first-hand information as to the methods which have led to the successful meat export trade from the island, and also to ascertain how far these are applicable to Rhodesia not only from the

point of view of the exporter, but even more from that of the farmer and the Government. The written information which the Committee has received on this point only strengthens its view as to the need of personal enquiry.

**17. Enquiries in the Congo.**—It is recommended that, in view of the great possibilities for the expansion of our cattle trade with the Belgian Congo, representatives of this country should be despatched without loss of time to make the fullest enquiries and to inform the stock owners of this country, through the Government, of the immediate and ultimate prospects of these nascent markets in the interior of Africa, which if not secured to Southern Rhodesia may fall into other hands. The form in which these supplies can best be provided, live, chilled, frozen or treated by the Bullot process, and the best means of securing these markets, are questions which can also best be decided only after enquiry on the spot.

**18. Bulls.**—The Committee agrees that only second in importance to finding outlets is improvement in the quality of our cattle. It is on the quality of our cattle that the building up of a permanent cattle industry primarily depends. Every effort must be made, therefore, to improve our cattle, and this cannot be done without the use of good bulls. To-day the number of pure-bred bulls in the hands of Europeans is only about a quarter (24.3 per cent.) of the total in use, whilst the natives owning nearly half the cattle in the country possess no pedigreed bulls; hence it may be said that less than one-eighth of the bulls in use in Southern Rhodesia are even nominally pure bred, and even fewer are pedigreed. The discouragement of the use of inferior bulls can only be achieved by educational processes. Besides the pedigreed bulls, and unregistered but reputed pure-bred sires, there are large numbers of high grade bulls in use for want of the true pedigreed animal, and this is unavoidable until these latter are obtainable in sufficient quantity, but it is not to be advocated or approved. Improvement of our cattle is most readily to be secured by encouragement of the use of superior bulls. The readiest and most effective method by which Government can assist, and the one the Committee is, therefore, disposed to advocate, is a scheme under which stock owners may be granted loans from Government funds to enable individuals to procure better bulls than otherwise they would do, and to encourage the use of registered animals. The following conditions should apply to such loans:—

- (1) The bull may be purchased by or on behalf of the purchaser through the usual commercial channels without Government intervention.
- (2) The bull is at the purchaser's risk, repayment of loan being due and payable whether the bull remains alive throughout the currency of the loan or not.
- (3) The bull shall be fully pedigreed, and registered prior to purchase.
- (4) The bull may be of any recognised breed.
- (5) Loans will be allowed in respect of only one bull at any one time to any one applicant.

- (6) Loans may be given to any person owning not less than 25 head of breeding stock, and being at the same time owner or tenant of the land on which they run, proof to be provided if required before a loan is granted.
- (7) Loans shall not exceed one-half the price actually paid, with a limit of £40. Railage and expenses are not included in estimating the price.
- (8) Repayment is to take place by equal instalments over not more than three years.
- (9) The loan shall bear interest at a rate not exceeding 10 per cent. per annum.
- (10) Security shall be provided in the form of one surety, who shall be an owner of immovable property in Southern Rhodesia.

The evils arising from the presence all over the country of excessive numbers of inferior bulls have received consideration. It was suggested to the Committee that, as in certain other countries, the presence of such bulls should be made a penal offence, but after consideration of all the evidence the opinion prevailed that in a country with a large native population still possessing very primitive ideas in regard to cattle it would be inexpedient to adopt such proposals, at any rate in the present state of our development.

**19. Fencing Law.**—The Committee considers fencing second only in importance to good bulls, and recommends that the principles of the Fencing Ordinance be now applied to the whole of Southern Rhodesia, instead of restricting them under the present system of local option.

Amendment of the fencing law is further recommended in respect of contribution by persons participating in the erection of boundary fences. At present a person called upon to contribute to a boundary fence need only pay his neighbour by instalments over five or ten years, according to the sum involved, with no security to the party erecting the fence, and with only 6 per cent. interest on his unpaid share. It is recommended that section 9 of the Fencing Ordinance be amended to provide that in the event of land owners required to contribute to the cost of joint fences not being in the position to (and failing to) do so, the Government shall pay the amount due and recover same by instalments with interest, placing a hypothecation for that purpose on the land, as in the case of loans under the Water Law of 1913 (sections 22 and 23).

**20. Fencing Loans.**—The Committee also recommends that a system of loans to encourage the erection of fences be adopted under which merchants would tender and contract with the Government to carry stocks of approved fencing material. This would be supplied at specially low tariff prices to stock owners against prompt cash on delivery payable by Government on behalf of approved purchasers, who in turn would make repayment and give security on the lines mentioned in the previous paragraph. The purchaser would select the firm from whom he wished to purchase, and the materials required, from amongst those annually recorded by the Government. The merchant would

deliver direct to the purchaser from stock which he would guarantee to hold in readiness. In this way fencing material could be obtained at a minimum price, much below present quotations, and farmer and merchant alike would benefit. The amount procurable in any one year would be limited by parliamentary vote of supplies for such loans.

**21. Railway Rates on Fencing.**—The railways have favourably considered representations of the Committee, and have agreed to substantial reductions in railway rates on fencing material. If the steps recommended in regard to loans are adopted by the Government, then the purchaser of fencing material will be enabled to secure the whole benefit of this reduction from Beira to his nearest station.

**22. Railway Rates on Cattle.**—Again, in response to representations by this Committee, the General Manager of Railways is arranging certain very material reductions on the rates for cattle to Johannesburg.

**23. Education and Propaganda.**—Though subordinate to the more urgent questions of finding markets and the direct stimulus to breeding, the Committee desires to recommend certain measures for propagating instruction in regard to the cattle industry amongst old and young.

To this end they suggest for the consideration of Government the appointment of one or more itinerant stock advisers attached to the Department of Agriculture to visit farmers and give practical advice in regard to care and feeding of cattle and the selection of bulls and breeding stock. Further, in this connection there is need for increased propaganda by Government amongst farmers in matters pertaining to cattle through instruction and demonstration, and through bulletins and the more frequent publication of the *Rhodesia Agricultural Journal*.

The Committee also recommends that special attention should be devoted at the Primary School of Agriculture, Matopos, to the care of cattle, including fattening of steers, handling of bulls, treatment of cows and minor operations.

**24. Stud Farms.**—As a means of improving the cattle of the country, the maintenance by the Government of stud cattle on the lines followed in other countries is recommended, subject to adequate funds being available after due provision has been made for carrying out our recommendations in regard to the securing of markets and assistance in other directions, and provided that steps be taken to ensure that only high-class stock be distributed by this means.

**25. Imperial Exhibition.**—The Committee recommends participation by Rhodesia in the Imperial Exhibition in London in 1924, in order specially to demonstrate the potentialities of the cattle industry.

**26. International Congress.**—The attention of the Government is also directed to the proposed Cattle Breeders' Congress summoned by the Netherlands Government to meet in August, 1923, and in the interest of our farmers it is requested that steps be taken to keep in touch with this movement.

**27. The Bullock Process.**—The Committee has had the advantage of direct evidence from Mr. Bullock on his process of treating meat, and

he is at present erecting a small plant in Bulawayo for the purpose of a practical demonstration. If the treatment is found to be satisfactory, it would render it possible to send meat instead of live stock to distant markets.

**28. Urgency.**—The Committee has been impelled to transmit this report to Government before its enquiries are completed, because the evidence so far obtained convinces it that, unless the recommendations put forward to deal with the present position by the expansion of local consumption, by boiling-down and freezing works, and by instituting active enquiries in regard to certain other markets are adopted at once, the situation, already grave, will become disastrous.

**29. Further Investigations.**—The Committee has not yet exhausted the field of its enquiries, and realises that points dealt with, and others, have still to be more fully considered. Further evidence will be welcomed, particularly suggestions for increasing our markets and information in regard to further outlets large or small.

**30. Summary of Recommendations.**—Without repeating the argument, we beg, in conclusion, to set out in condensed form our various recommendations to Government to date, and commend them to its earnest consideration.

(1) That the present highly critical situation calls for Government intervention involving expenditure. (Section 7.)

(2) That development of markets is of the first importance, primarily in Europe, but also elsewhere overseas, and to inland countries wherever a demand exists; and that it is the function of the Government to assist private enterprise to achieve this end by every means possible. (Section 5.)

(3) That, with this end in view, the Government invite representatives of meat packing concerns throughout the world to visit Southern Rhodesia for the purpose of satisfying themselves as to the quality of our cattle, and studying on the spot the prospects of establishing meat works here. Attention is called to the propaganda of the South African Trade Association, London, in this connection. (Section 12.)

(4) That the Government should immediately invite, by world-wide advertisement, competent capitalists to enter upon the business of meat export from Southern Rhodesia, and to that end afford them every assistance within its power (section 11), including:—

- I. Remission of taxation for a period of years [section 7 (c)].
- II. Exemption from Customs dues [section 7 (c)].
- III. Exclusive rights of oversea export for a certain time [section 7 (d)].
- IV. Bounties on meat exported [section 7 (f)].
- V. Support in requests for port facilities [section 7 (g)].
- VI. Railway advantages [section 7 (h)].
- VII. Favourable ocean freights [section 7 (i)].

VIII. Assistance from municipalities and local authorities [section 7 (b)].

IX. Assurance as to duration of privileges [section 7 (j)].

(5) That legislation is called for at an early date relating to control and inspection of meat and of meat works before these are established. (Section 7 (j).)

(6) That enquiries be instituted by personal investigation on behalf of Government as to the possibilities of extending our markets in the Belgian Congo. (Section 17.)

(7) That no cattle should be permitted to be exported by rail to places outside Southern Rhodesia until they have been inspected by competent veterinary inspectors and a certificate granted that they are fit to stand the journey without undue deterioration or cruelty. (Section 4 (c).)

(8) That steps be taken by Government with a view to the removal of the present restrictions on the passage of cattle by rail through Northern Rhodesia to the Congo. (Section 4 (c).)

(9) That the present obligatory rations to natives be modified by the substitution of one pound of meat weekly for two pounds of beans. (Section 5 (c).)

(10) That special delegates be despatched to Mauritius and Egypt to ascertain the prospects of obtaining outlets for our cattle, alive or as beef. (Section 5 (d).)

(11) That the investigations of the Committee on a number of subjects of importance be extended to the Union of South Africa through visits by a sub-committee. (Section 15.)

(12) That a representative of the Government be despatched to make enquiries into the cattle industry and the meat export trade of Madagascar. (Section 16.)

(13) That a system of loans be adopted to encourage the use of superior bulls. (Section 18.)

(14) That the Fencing Ordinance be applied throughout the country, deleting the element of local option, and that the law be otherwise amended. (Section 19.)

(15) That a system of fencing loans on the lines of loans under the Water Law be adopted. (Section 20.)

(16) Recommendations in regard to reductions in railway rates on fencing and on live stock are receiving favourable consideration. (Sections 21 and 22.)

(17) That stock advisers be appointed to give practical assistance to farmers. (Section 23.)

(18) That special attention be devoted to instruction in the care and handling of cattle at the Primary School of Agriculture, Matopos. (Section 23.)

(19) That more active educational propaganda in support of the cattle industry be undertaken by the Government. (Section 23.)

(21) That the potentialities of Southern Rhodesia as a cattle country be advertised at the Imperial Exhibition in 1924. (Section 25.)

(22) That the Government keep in touch with the proposed International Cattle Breeders' Congress in Holland in August, 1923. (Section 26.)

The present and potential markets for the cattle of Southern Rhodesia may be briefly recapitulated as follows:—

|                                                             |         |      |
|-------------------------------------------------------------|---------|------|
| Local consumption ... ..                                    | 90,000  | head |
| Union of South Africa—slaughter ... ..                      | 15,000  | „    |
| Katanga (Congo)—slaughter ... ..                            | 3,000   | „    |
| breeding ... ..                                             | 500     | „    |
| Northern Rhodesia—breeding ... ..                           | Nominal |      |
| Mozambique Co.'s Territory—slaughter and<br>breeding ... .. | 1,000   | „    |

Kasai, etc. (Congo)—slaughter.  
Nyasaland—breeding.  
Canning Factory—slaughter.  
England—slaughter.  
Europe—slaughter.  
Egypt—slaughter.  
Mauritius—slaughter and draught.  
Boiling-down Works—slaughter.  
Meat Extraction—slaughter.

**Acknowledgments.**—Acknowledgment is due to the many persons, too numerous to name, who have assisted the Committee by furnishing their views in writing and also those who have given oral evidence. These opinions and suggestions have received careful consideration, and have materially contributed to the conclusions so far arrived at by the Committee.

The Committee is under an obligation to its Secretary, Mr. Bertram Woods, for the assiduous and able manner in which he has carried out his duties.

M. E. CLEVELAND.

C. S. JOBLING.

H. U. MOFFAT.

-O. C. RAWSON.

18th April, 1923.



# Statistics of Live Stock and Animal Products

FOR THE YEAR 1922.

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By A. BORRADAILE BELL, Statistician.

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One of the many uses of statistics of production is that they furnish at any moment a measure of the position or progress of the country or of any particular industry. An examination of the appended figures will show that as compared with those for 1921, this country has not achieved the usual progress as far as live stock and the products connected therewith are concerned, and has in some directions suffered an actual set back.

Dealing with European-owned stock, the total net increase is 31,211 or 3.4 per cent., as compared with the average increase of 14.08 per cent. for the previous five years. As is only to be expected, the decrease in native-owned cattle shows a greater difference, the net increase being only 19,396 or 2.3 per cent., as compared with 11.68 per cent. for the previous five years. The diminished rate of increase happens to follow a year of exceptionally high increase, viz., 17.1 per cent. in 1921. Even without the drought and other causes, a low figure for 1922 was only to be expected.

In looking for an explanation a statistician has mainly to rely on facts as supplied by definite figures, and where these are not available he can only suggest possible reasons. The general cause which has affected unfavourably all live stock, with the exception of sheep and goats, was undoubtedly the severe drought, which acted in two ways—directly in losses to stock and indirectly on the financial position of the farmer. The drought not only caused mortality from poverty, but also led to the death of many calves at birth or shortly thereafter, and further prevented many cows from breeding, thus affecting prejudicially the birth-rate. A second cause would appear to be disease, especially amongst cattle. East Coast fever, quarter-evil and contagious abortion have undoubtedly taken a toll. Amongst natives there was also increased consumption of cattle owing to famine.

An increased export of 23,938 head of cattle in 1922, as against 12,348 in 1921, also tends to reduce the total head at the end of the year, though this figure in itself may be regarded as a healthy sign.

The extent to which certain of the above causes have contributed to the final result can only be surmised, as no figures as to actual losses, except East Coast fever, are available.

The fact that the export of hides was nearly doubled may be some indication of an increased death roll. The actual figures in this connection are as follows:—

#### HIDES EXPORTED.

| Class.              | 1921.        |         | 1922.          |         |
|---------------------|--------------|---------|----------------|---------|
|                     | Quantity.    | Value.  | Quantity.      | Value.  |
| Cattle ... ..       | 695,001 lbs. | £18,305 | 1,301,728 lbs. | £35,930 |
| Sheep and Goats ... | 105,616 ..   | £2,956  | 140,649 ..     | £4,063  |
|                     | 800,617 lbs. | £21,261 | 1,442,377 lbs. | £39,993 |

Turning to the imports and exports we have facts which seem to bear out the conclusion that the financial depression, consequent on the drought, and the general political uncertainty, have had a marked effect on the live stock industry of the country. All imports of live stock show a considerable falling off, as revealed by the following figures:—

#### IMPORTS.

| Class.                 | 1921   | 1922   |
|------------------------|--------|--------|
| Cattle ... ..          | 1,007  | 712    |
| Horses ... ..          | 1,495  | 561    |
| Mules ... ..           | 397    | 264    |
| Donkeys ... ..         | 679    | 521    |
| Sheep and Goats ... .. | 28,533 | 27,732 |
| Pigs ... ..            | 78     | 7      |

Further evidences of the financial depression above referred to as one of the causes of the set back to the industry are found in the temporary abandonment or curtailment of farming operations, evidenced in the number of "nil" returns received, as well as in letters received from owners of farms who have taken up other occupa-

tions, and have either abandoned their farms temporarily or have left a native in charge of a small number of stock.

The total number of stock owners dealt with was 2,337, of whom all except seven furnished returns, and these latter probably only represent about a thousand head of cattle.

**Cattle.**—The total number of cattle owned by Europeans is shown as 936,251, an increase of 31,211 on the corrected total for 1921. The native-owned cattle, according to statistics furnished by the Native Department, number 864,894, an increase of 19,396. This makes a grand total at 31st December, 1922, of 1,801,145. The net increase for all cattle is 50,607, equal to 2.9 per cent. This shortfall in the rate of increase has been dealt with and such explanation as is possible given above.

#### INCREASE OF CATTLE, 1917 TO 1922.

| Year.    | As at 31st December.   |                      |               | Net Annual Increase per cent. |         |        |
|----------|------------------------|----------------------|---------------|-------------------------------|---------|--------|
|          | European-owned Cattle. | Native-owned Cattle. | Total Cattle. | European.                     | Native. | Total. |
| 1917 ... | 532,311                | 551,632              | 1,083,943     | 13.6                          | 12.2    | 12.9   |
| 1918 ... | 600,447                | 610,100              | 1,210,547     | 12.8                          | 10.6    | 11.7   |
| 1919 ... | 678,508                | 652,776              | 1,331,284     | 13.0                          | 7.0     | 10.0   |
| 1920 ... | 772,891                | 744,402              | 1,517,293     | 13.9                          | 14.0    | 14.0   |
| 1921 ... | 905,040                | 845,498              | 1,750,538     | 17.1                          | 13.6    | 15.4   |
| 1922 ... | 936,251                | 864,894              | 1,801,145     | 3.4                           | 2.3     | 2.9    |

The following classification of owners of herds of 500 and over shows a satisfactory increase, considering the conditions existing during the year, the total of such owners having risen from 336 to 357. The principal rise occurs amongst owners of 1,000 to 2,000 head, the numbers of whom have risen from 59 to 72.

| Over 500 but under 1,000 | 1,000 to 2,000 | 2,000 to 3,000 | 3,000 to 4,000 | 4,000 to 5,000 | 5,000 to 10,000 | 10,000 to 20,000 | 20,000 to 40,000 | Over 40,000 | Total. |
|--------------------------|----------------|----------------|----------------|----------------|-----------------|------------------|------------------|-------------|--------|
| 237                      | 72             | 28             | 5              | 3              | 6               | 2                | 2                | 2           | 357    |

## COMPOSITION OF EUROPEAN-OWNED HERDS.

|                              | 1921.   |           | 1922.   |           |
|------------------------------|---------|-----------|---------|-----------|
|                              | Totals. | Per cent. | Totals. | Per cent. |
| Cows and Heifers over 1 year | 418,544 | 46.2      | 429,941 | 45.9      |
| Heifers under 1 year ...     | 113,217 | 12.5      | 113,101 | 12.1      |
| Total Females ...            | 531,761 | 58.7      | 543,042 | 58.0      |
| Stud Bulls ... ..            | 11,030  | 1.2       | 11,056  | 1.2       |
| Other Bulls and Bull Calves  | 82,269  | 9.1       | 93,431  | 10.0      |
| Trained Oxen ... ..          | 89,508  | 9.9       | 95,192  | 10.1      |
| Other Oxen ... ..            | 190,472 | 21.1      | 193,530 | 20.7      |
| Total Males ... ..           | 373,270 | 41.3      | 393,209 | 42.0      |

The position of the various classes of cattle has altered very slightly. The proportion of males to females has risen, but the increase is not as would be supposed in "other oxen," but in "other bulls and bull calves." This may be due to tollies having been shown as bull calves, but next year a separate heading will be shown for this class, which will obviate any misunderstanding. The increase of 11,590 in the export of cattle has also had its effect in reducing the percentage of "other oxen."

The following tables show the imports and exports of cattle as compared with the figures for 1921:—

## IMPORTS.

| Origin.                   | 1921.  |                   | 1922.  |                   |
|---------------------------|--------|-------------------|--------|-------------------|
|                           | Bulls. | Cows and Heifers. | Bulls. | Cows and Heifers. |
| United Kingdom ... ..     | 36     | 22                | 12     | 9                 |
| Union of South Africa ... | 592    | 357               | 418    | 272               |
| U.S.A. ... ..             | —      | —                 | 1      | —                 |
| Total ... ..              | 628    | 379               | 431    | 281               |

There has, for a number of years past, been a steady diminution of the number of stud cattle imported from the United Kingdom, our needs in this respect being supplied locally and from the Union. The reduction of importations from the Union, especially of bulls, is, however, a sign of bad times, for the great need of improving our cattle is fully recognised, and would be practised if circumstances permitted.

## EXPORTS.

| Destination.          | 1921.       |            |            | 1922.       |            |            |
|-----------------------|-------------|------------|------------|-------------|------------|------------|
|                       | Slaugh-ter. | Breed-ing. | Trek Oxen. | Slaugh-ter. | Breed-ing. | Trek Oxen. |
| Union of S.A. ... ..  | 6,958       | 3,145      | 174        | 16,716      | 2,636      | ...        |
| Northern Rhodesia ... | —           | 21         | —          | —           | 61         | ...        |
| Congo ... ..          | —           | 351        | —          | 2,552       | 568        | ...        |
| Portuguese E.A. ...   | 1,006       | 465        | 228        | 303         | 922        | 180        |
| Total ... ..          | 7,964       | 3,982      | 402        | 19,571      | 4,187      | 180        |

The export of slaughter stock to the Union was larger in 1922 than in 1921, but the value was greatly reduced per head, and the export of breeding stock to the south has now been prohibited. The effect of opening the Congo market for four and a half months during last year has become apparent, and there is reason to hope this market will expand.

*Pure-bred Cattle.*—The total pure-bred cattle including Africanders is 9,254, an increase of 506, equal to 5.8 per cent. as compared with 280 or 3.3 per cent. for 1921. As the imports of breeding stock were less and the exports more during 1922, the figures indicate that the breeding of pure-bred animals in the country is making progress.

The total increase is in European breeds, for after eliminating Africanders, the net increase is raised to 731. The increase in 1921 over 1920 was entirely confined to stud bulls, for all females as well as other bulls showed a falling off in numbers. During 1922 the main increase has been in females, though all classes and sexes show an improvement on the totals for 1921. The following is the composition of pure-bred herds:—

|                              | 1921.   |           | 1922.   |           |
|------------------------------|---------|-----------|---------|-----------|
|                              | Totals. | Per cent. | Totals. | Per cent. |
| Cows and Heifers over 1 year | 3,761   | 43.0      | 4,133   | 44.7      |
| Heifers under 1 year ...     | 988     | 11.3      | 1,052   | 11.3      |
| Total Females ...            | 4,749   | 54.3      | 5,185   | 56.0      |
| Stud Bulls ... ..            | 2,706   | 30.9      | 2,765   | 29.9      |
| Other Bulls and Bull Calves  | 1,293   | 14.8      | 1,304   | 14.1      |
| Total Males ... ..           | 3,999   | 45.7      | 4,069   | 44.0      |

In dealing with pure-bred cattle it is to be recollected that it is not necessarily or only animals registered in the stud book that are included, but all those described in the returns as pure-bred by their owners, and that no check on such statements is possible. In practice, therefore, a number of animals apparently or believed to belong to the breed specified are included. From the figures given it is evident that stock owners as a rule only enter under this category a few of their animals, never large herds, so that it may reasonably be taken that the cattle referred to are at any rate of very superior quality and not ordinary grade stock.

The relative position of the breeds as compared to last year has altered slightly. Africanders still head the list with 1,672, but this breed is annually decreasing in numbers. The total shown under this heading in 1920 was 2,770, in 1921 1,897, and in 1922 1,672. Either the popularity of this class is waning, or, as is more probable, the remarks made last year still apply, and animals classed as pure-bred in 1921 are not now so regarded by their owners.

With regard to European breeds, Shorthorns have dropped considerably in numbers from 1,750 to 1,435. In this case again probably the reduction is due in part to greater precision in describing purity of breeding, though it must be admitted that there has been a falling off also in importation of Shorthorn bulls. All other breeds show an increase except Ayrshires and Jerseys, the principal rise being in the case of Frieslands. The increase in Devons is entirely due to females; there are actually fewer bulls in this breed than were recorded in 1921. Devons and Herefords change places, the former now exceeding the latter by a few head, and South Devon rise from ninth to seventh place. Appended is a comparative statement for the last three years, which shows the position of each breed in point of numbers:—

| Breed.         | 1920.  |          |        | 1921.  |          |        | 1922.  |          |        |
|----------------|--------|----------|--------|--------|----------|--------|--------|----------|--------|
|                | Bulls. | Females. | Total. | Bulls. | Females. | Total. | Bulls. | Females. | Total. |
|                |        |          |        |        |          |        |        |          |        |
| Shorthorn ...  | 685    | 910      | 1,595  | 815    | 935      | 1,750  | 702    | 733      | 1,435  |
| Red Lincoln    | 141    | 101      | 242    | 189    | 165      | 354    | 186    | 236      | 422    |
| Devon ...      | 434    | 513      | 947    | 508    | 546      | 1,054  | 483    | 923      | 1,406  |
| South Devon    | 104    | 181      | 285    | 157    | 169      | 326    | 180    | 244      | 424    |
| Hereford ...   | 450    | 464      | 914    | 557    | 653      | 1,210  | 660    | 717      | 1,377  |
| Friesland ...  | 248    | 556      | 804    | 284    | 737      | 1,021  | 332    | 981      | 1,313  |
| Aberdeen Angus | 249    | 227      | 476    | 371    | 265      | 636    | 407    | 293      | 700    |
| Sussex ...     | 189    | 141      | 330    | 195    | 174      | 369    | 219    | 177      | 396    |
| Red Poll ...   | 25     | 28       | 53     | 43     | 7        | 50     | 48     | 29       | 77     |
| Ayrshire ...   | 25     | 23       | 48     | 40     | 27       | 67     | 12     | 8        | 20     |
| Africander     | 978    | 1,792    | 2,770  | 849    | 1,048    | 1,897  | 839    | 833      | 1,672  |
| Other Breeds   | 1      | 3        | 4      | 8      | 6        | 14     | 5      | 7        | 12     |
| Grand Total    | 3,529  | 4,939    | 8,468  | 4,016  | 4,732    | 8,748  | 4,073  | 5,181    | 9,254  |

**Horses.**—The number of horses, 3,208, remained in 1922 practically what it was the year before, the difference only being 15. The number imported has dropped from 1,495 in 1921 to 561, or 62.5 per cent. The exports have also decreased from 90 to 62, or 31.1 per cent. No figures are available as to the number lost through horse-sickness, and as the above total does not include horses in urban areas or on the Police strength, while the exports and imports include both, it is impossible to arrive at any definite estimate of the loss through disease.

**Mules.**—The decrease in the number of mules in the country is 497. The imports were 264, or 133 less than in 1921, and the exports 39, which is 5 more.

**Donkeys.**—The total number is 9,219, being a decrease of 847 on 1921; 158 less were imported and 169 less exported than in the previous year.

**Sheep and Goats.**—This branch of the industry shows an increase over the 1921 figures, and the reason would appear to be that they are less affected by the dry conditions than other classes of stock. The exports and imports, however, show the same falling off as other live stock. Imports, 27,732, are 801 less than in 1921, and exports decreased by 385. The increase in sheep above mentioned is confined to "all other sheep," for Merinos show a falling off in numbers. The total in this class is 8,439, a decrease of 340, or 3.9 per cent. The total of "all other sheep" is 52,885, a net increase of 8,720 on the 1921 figures, equal to 19.7 per cent. Goats have increased from 18,814 to 20,987, the net increase of 2,173 being equal to 11.5 per cent.

**Pigs.**—The total number of pigs in the country was 21,505, which shows a large decrease of 5,167, equal to 19.4 per cent., on the 1921 figures, while the imports only amounted to 7, as against 78 in 1921. There is a small increase of 418 in the total number exported. To the drought again must the shortfall be attributed, for with the want of green food and with maize at the high price reached, it was obviously impossible to breed pigs profitably. This is again reflected in the bacon and ham produced locally, the production being 68,000 lbs. less than last year. The export of bacon and hams also shows a shortfall of 7,654 lbs.

**Poultry.**—This class of stock suffered from the high cost of the necessary foodstuffs owing to the drought, breeding being in consequence restricted. The total number, according to returns received, is 133,227, being a decrease of 25,882, equal to 16.3 per cent. There is a source of error here, in that all poultry raisers are not farmers, and those that are seem careless in furnishing returns under this head. In quite a number of cases eggs were shown, but no poultry. In these instances an enquiry was possible and the number of poultry ascertained, but probably in many cases both were omitted.

The following table shows the increase or decrease in the various kinds of European-owned live stock other than cattle given elsewhere:—



|                  | 1921    | 1922    | Plus<br>Difference | Plus<br>Percentage. | Minus<br>Difference. | Minus<br>Percentage. |
|------------------|---------|---------|--------------------|---------------------|----------------------|----------------------|
| Horses ... ..    | 3,223   | 3,208   | ...                | ...                 | 15                   | ·05                  |
| Mules ... ..     | 2,393   | 1,896   | ...                | ...                 | 497                  | 20·8                 |
| Donkeys ... ..   | 10,066  | 9,219   | ...                | ...                 | 847                  | 8·4                  |
| Sheep, Merino... | 8,779   | 8,439   | ...                | ...                 | 340                  | 3·9                  |
| ,, all other     | 44,165  | 52,885  | 8,720              | 19·7                | ...                  | ...                  |
| Goats ... ..     | 18,814  | 20,987  | 2,173              | 11·5                | ...                  | ...                  |
| Pigs ... ..      | 26,672  | 21,505  | ...                | ...                 | 5,167                | 19·4                 |
| Poultry ... ..   | 159,109 | 133,227 | ...                | ...                 | 25,882               | 16·3                 |

EXPORTS AND IMPORTS--ANIMALS OTHER THAN CATTLE,  
WITH COUNTRIES OF DESTINATION OR ORIGIN.

| Class.             | Destination or origin.    | Exports. |       | Imports. |        |
|--------------------|---------------------------|----------|-------|----------|--------|
|                    |                           | 1921.    | 1922. | 1921.    | 1922.  |
| Horses             | Union of South Africa...  | 6        | 10    | 1,495    | 561    |
|                    | Northern Rhodesia ...     | 42       | 38    | ...      | ...    |
|                    | Congo ... ..              | 16       | 4     | ...      | ...    |
|                    | Portuguese East Africa    | 26       | 10    | ...      | ...    |
| Mules              | Union of South Africa...  | 3        | 4     | 397      | 264    |
|                    | Northern Rhodesia ...     | 2        | 6     | ...      | ...    |
|                    | Congo ... ..              | 10       | 24    | ...      | ...    |
|                    | Portuguese East Africa    | 19       | 5     | ...      | ...    |
| Donkeys            | Union of South Africa...  | ...      | 12    | 679      | 521    |
|                    | Northern Rhodesia ...     | 215      | 14    | ...      | ...    |
|                    | Congo ... ..              | 133      | 60    | ...      | ...    |
|                    | Portuguese East Africa    | 9        | 102   | ...      | ...    |
| Sheep and<br>goats | Union of South Africa ... | 296      | ...   | 28,533   | 27,732 |
|                    | Northern Rhodesia ...     | 698      | 1,361 | ...      | ...    |
|                    | Congo ... ..              | 1,233    | 485   | ...      | ...    |
|                    | Portuguese East Africa    | 279      | 275   | ...      | ...    |
| Pigs               | Union of South Africa...  | 495      | 1,327 | 78       | 7      |
|                    | Northern Rhodesia ...     | 125      | 98    | ...      | ...    |
|                    | Congo ... ..              | 624      | 351   | ...      | ...    |
|                    | Portuguese East Africa    | 210      | 96    | ...      | ...    |

**Animal Products.—Eggs.**—The figures given under this heading cannot be taken as the total eggs sold, for the same reasons as those given in respect of poultry. The total number is shown as 193,347 dozen, which is 20,431 dozen less than 1921.

**Cream.**—The quantity of cream sold as cream was 204,034 lbs., and as butter fat 168,091 lbs., which, reckoning cream as 40 per cent. butter fat, makes the total cream sold 624,261 lbs., as compared with 833,507 lbs. in 1921. This decrease is not surprising in view of the conditions prevailing during 1922. The low price paid by the creameries for butter fat has also had its effect, as it will be noticed that the production of farm butter has increased. At the price offered it evidently paid the farmer better to make and sell his own butter than to dispose of his cream to the creameries.

**Milk.**—Milk sold amounted to 3,666,702 lbs., as compared with 4,351,485 lbs. in 1921. Despite the drought, to which the decrease is attributed, the quantity sold was still 1,000,000 lbs. above the 1920 figure.

**Butter.**—The total farm butter sold was 292,964 lbs., an increase of 37,860 lbs. This, the only increase shown in animal products, is probably attributable, as stated above, to the low price to be obtained for cream from the creameries. The total butter produced by the creameries was 282,850 lbs., making a total in all of 575,814 lbs. The exports were 277,700 lbs., and imports 172,225 lbs., as against 421,815 lbs. and 84,497 lbs. respectively in 1921.

**Cheese.**—The cheese manufactured on farms during the year was 39,333 lbs., as against 41,854 lbs. in 1921. The difference is small and undoubtedly due to the drought. There is considerable activity in this branch of the industry, and with the favourable season, the amount manufactured this year will probably show a large increase. The imports during the year amounted to 114,632 lbs., valued at £6,007, and of this amount 110,931 lbs. came from the Union of South Africa. With the increased activity reported in the making of farm cheese, the local market will soon be fully supplied, and the problem of a market for the balance will then arise.

**Wool.**—The wool sold during the year was 16,914 lbs., an increase of 2,507 on the 1921 figure of 14,407.





TABLE No. 4.

| District.       | Animal Products sold, 1922. |                                |                           |               |                 | Farm Vehicles. |                 |               |                 |                   |                        |
|-----------------|-----------------------------|--------------------------------|---------------------------|---------------|-----------------|----------------|-----------------|---------------|-----------------|-------------------|------------------------|
|                 | Eggs,<br>doz.               | Cream.                         |                           | Milk,<br>lbs. | Butter,<br>lbs. | Wool,<br>lbs.  | Cheese,<br>lbs. | Ox<br>Wagons. | Mule<br>Wagons. | Donkey<br>Wagons. | Ox<br>Scotch<br>Carts. |
|                 |                             | Sold as<br>Butter Fat,<br>lbs. | Sold as<br>Cream,<br>lbs. |               |                 |                |                 |               |                 |                   |                        |
| Wankie          | 5,897                       | 2,468                          | 1,733                     | 189,092       | 12,456          | ...            | ...             | 28            | 7               | ...               | 18                     |
| Nyamaudlovu     | 4,884                       | 1,920                          | 188                       | 21,877        | 3,895           | ...            | ...             | 50            | 2               | 5                 | 19                     |
| Bulalima-Mangwe | 15,321                      | 30,834                         | 41,333                    | 47,193        | 4,196           | ...            | ...             | 62            | 5               | 16                | 50                     |
| Matobo          | 2,619                       | 4,207                          | ...                       | 319,870       | 8,639           | ...            | 20              | 31            | 8               | 13                | 25                     |
| Umzingwane      | 6,112                       | 8,827                          | 9,061                     | 55,640        | 14,683          | ...            | 80              | 35            | 3               | 4                 | 12                     |
| Bulawayo        | 23,140                      | 4,265                          | 8,763                     | 673,862       | 9,853           | ...            | 900             | 35            | 5               | 16                | 22                     |
| Bubi            | 4,342                       | 19,636                         | 11,841                    | 89,079        | 11,919          | ...            | ...             | 108           | 9               | 16                | 36                     |
| Selungwe        | ...                         | ...                            | ...                       | ...           | ...             | ...            | ...             | 7             | ...             | ...               | 1                      |
| Gwelo           | 27,007                      | 20,156                         | 42,825                    | 150,476       | 24,319          | 4,532          | 9               | 160           | 10              | 17                | 64                     |
| Selukwe         | 2,491                       | 3,191                          | 1,436                     | 59,589        | 3,692           | ...            | 250             | 89            | 4               | 7                 | 16                     |
| Isutha          | 5,928                       | 6,591                          | 12,761                    | 4,185         | 3,687           | 1,200          | ...             | 74            | 5               | 11                | 41                     |
| Gwanda          | 404                         | ...                            | 1,300                     | 14,800        | 1,171           | ...            | ...             | 32            | 3               | 14                | 17                     |
| Belingwe        | 764                         | ...                            | ...                       | 36,870        | 1,500           | ...            | ...             | 50            | ...             | 6                 | 28                     |
| Victoria        | 3,522                       | 1,472                          | 3,880                     | 41,020        | 4,466           | 2              | 1,500           | 102           | 2               | 15                | 40                     |
| Chilimanzi      | 6,186                       | 3,366                          | 1,389                     | 53,160        | 3,147           | ...            | ...             | 54            | 7               | 3                 | 29                     |
| Hartley         | 15,822                      | 4,627                          | 14,726                    | 368,209       | 17,432          | ...            | 30,092          | 175           | 9               | 9                 | 82                     |
| Lomagundi       | 8,027                       | 32,996                         | 14,618                    | 50,257        | 15,264          | ...            | 317             | 146           | 7               | ...               | 67                     |
| Mazoe           | 10,876                      | 7,286                          | 6,271                     | 40,757        | 11,964          | ...            | 200             | 245           | 19              | 15                | 81                     |
| Salisbury       | 18,451                      | 5,397                          | 10,137                    | 1,211,929     | 63,046          | 380            | 1,500           | 184           | 21              | 29                | 79                     |
| Marandellas     | 2,822                       | 1,766                          | 7,567                     | 2,180         | 11,702          | 95             | 209             | 70            | 5               | 1                 | 24                     |
| Charter         | 3,317                       | 2,749                          | 6,939                     | 5,975         | 4,932           | ...            | 1,410           | 51            | 5               | 14                | 19                     |
| Guta            | 698                         | 3,804                          | 2,040                     | ...           | 669             | 650            | ...             | 21            | 1               | 2                 | 9                      |
| Ndanga          | ...                         | ...                            | ...                       | ...           | ...             | ...            | ...             | 10            | 1               | 2                 | 3                      |
| Gubi            | ...                         | ...                            | ...                       | ...           | ...             | ...            | ...             | 25            | ...             | 2                 | 13                     |
| Bikita          | ...                         | ...                            | ...                       | ...           | ...             | ...            | ...             | 6             | ...             | ...               | 6                      |
| Melsetter       | 1,680                       | ...                            | 40                        | 10,102        | 6,038           | 4,200          | 270             | 23            | 5               | 25                | 8                      |
| Umtali          | 10,388                      | 140                            | 360                       | 222,788       | 23,962          | 2,276          | ...             | 76            | 10              | 11                | 35                     |
| Makoni          | 10,850                      | 2,316                          | 4,706                     | 18,692        | 24,268          | ...            | 2,549           | 92            | 3               | 6                 | 27                     |
| Inyanga         | 475                         | 147                            | ...                       | ...           | 484             | 3,579          | 27              | 13            | 2               | 3                 | 4                      |
| Mrewa           | 1,276                       | ...                            | 120                       | ...           | 3,660           | ...            | ...             | 18            | ...             | ...               | 5                      |
| Mtoko           | ...                         | ...                            | ...                       | ...           | ...             | ...            | ...             | 2             | ...             | ...               | 2                      |
| Darwin          | 48                          | ...                            | ...                       | ...           | 130             | ...            | ...             | 8             | ...             | 1                 | 1                      |
| Totals          | 183,347                     | 168,091                        | 204,034                   | 3,666,702     | 292,964         | 16,914         | 39,333          | 2,077         | 158             | 263               | 883                    |

TABLE No. 3.

| District.              | Horses. | Mules. | Donkeys. | Sheep.  |            | Goats. | Pigs.  | Poultry. |
|------------------------|---------|--------|----------|---------|------------|--------|--------|----------|
|                        |         |        |          | Merino. | All other. |        |        |          |
| Wankie ... ..          | 20      | 29     | 62       | ...     | 357        | 85     | 210    | 2,598    |
| Nyamandhlovu ... ..    | 58      | 22     | 229      | ...     | 979        | 303    | 482    | 2,722    |
| Bulalima-Mangwe ... .. | 239     | 52     | 658      | 71      | 3,418      | 1,524  | 962    | 8,708    |
| Matobo ... ..          | 96      | 96     | 554      | 87      | 1,945      | 441    | 243    | 1,922    |
| Umzingwane ... ..      | 49      | 25     | 283      | 250     | 1,770      | 211    | 314    | 3,339    |
| Bulawayo ... ..        | 92      | 33     | 404      | 20      | 920        | 165    | 287    | 9,675    |
| Bubi ... ..            | 107     | 69     | 675      | 215     | 2,551      | 828    | 724    | 3,900    |
| Sebungwe ... ..        | 5       | ...    | 6        | 65      | 5          | 15     | 124    | ...      |
| Gwelo ... ..           | 252     | 172    | 633      | 1,465   | 5,527      | 1,146  | 1,676  | 14,624   |
| Selukwe ... ..         | 83      | 36     | 73       | 172     | 765        | 343    | 848    | 2,272    |
| Insiza ... ..          | 188     | 77     | 484      | 397     | 4,409      | 911    | 484    | 3,720    |
| Gwanda ... ..          | 76      | 46     | 456      | 13      | 596        | 379    | 138    | 887      |
| Belingwe ... ..        | 76      | 38     | 232      | ...     | 1,411      | 448    | 209    | 1,221    |
| Victoria ... ..        | 106     | 38     | 524      | 164     | 3,110      | 1,297  | 532    | 4,205    |
| Chilimanzi ... ..      | 90      | 61     | 219      | 340     | 1,021      | 307    | 415    | 3,944    |
| Hartley ... ..         | 122     | 82     | 433      | 118     | 3,530      | 1,076  | 1,579  | 9,226    |
| Lomagundi ... ..       | 69      | 58     | 108      | 35      | 2,299      | 1,444  | 1,453  | 8,335    |
| Mazoe ... ..           | 237     | 242    | 233      | 27      | 2,979      | 479    | 3,613  | 8,974    |
| Salisbury ... ..       | 189     | 206    | 682      | 272     | 2,649      | 648    | 2,801  | 13,988   |
| Marandellus ... ..     | 92      | 38     | 118      | 12      | 913        | 336    | 668    | 4,094    |
| Charter ... ..         | 287     | 85     | 649      | 448     | 1,838      | 1,043  | 628    | 4,237    |
| Gutu ... ..            | 43      | 10     | 46       | 46      | 1,010      | 417    | 245    | 1,891    |
| Ndanga ... ..          | 24      | 6      | 78       | ...     | 293        | 142    | 71     | 279      |
| Chibi ... ..           | 27      | 41     | 3        | ...     | 111        | 102    | 7      | 85       |
| Bikita ... ..          | 3       | 11     | ...      | ...     | 152        | 10     | 21     | 143      |
| Melsetter ... ..       | 232     | 99     | 783      | 2,296   | 4,771      | 3,973  | 704    | 3,348    |
| Umtali ... ..          | 154     | 137    | 251      | 920     | 1,350      | 1,954  | 668    | 6,021    |
| Makoni ... ..          | 140     | 58     | 120      | 222     | 1,384      | 561    | 955    | 6,514    |
| Inyanga ... ..         | 23      | 19     | 126      | 783     | 568        | 147    | 152    | 796      |
| Mrewa ... ..           | 13      | 8      | 49       | 1       | 154        | 152    | 170    | 1,272    |
| Mtoko ... ..           | 1       | ...    | 7        | ...     | ...        | ...    | 3      | 12       |
| Darwin ... ..          | 15      | 2      | 41       | ...     | 100        | 100    | 129    | 175      |
| Totals ... ..          | 3,208   | 1,896  | 9,219    | 8,439   | 52,885     | 20,987 | 21,505 | 133,227  |

TABLE No. I.

| District.         | Total Cattle. | Cows and Heifers over 1 year. | Heifers under 1 year, including Heifer Calves. | Stall Bulls. | Other Bulls and Bull Calves. | Trained Oxen. | Other Oxen. |
|-------------------|---------------|-------------------------------|------------------------------------------------|--------------|------------------------------|---------------|-------------|
| Wankie ... ..     | 9,367         | 4,520                         | 1,019                                          | 95           | 1,075                        | 809           | 1,840       |
| Nyamandhlovu      | 15,611        | 6,341                         | 1,910                                          | 108          | 1,623                        | 2,730         | 2,899       |
| Bulalima-Mangwe   | 35,256        | 17,339                        | 4,532                                          | 415          | 3,509                        | 2,265         | 7,176       |
| Matobo ... ..     | 18,179        | 8,472                         | 2,643                                          | 171          | 1,765                        | 1,100         | 4,028       |
| Umzingwane ...    | 13,422        | 6,457                         | 1,451                                          | 126          | 1,124                        | 1,261         | 3,003       |
| Bulawayo ... ..   | 10,631        | 5,346                         | 1,169                                          | 90           | 906                          | 1,612         | 1,499       |
| Bubi ... ..       | 37,604        | 16,526                        | 4,834                                          | 405          | 3,431                        | 3,366         | 9,042       |
| Sebungwe ... ..   | 674           | 199                           | 84                                             | 3            | 127                          | 161           | 60          |
| Gwelo ... ..      | 83,470        | 40,856                        | 11,009                                         | 1,119        | 9,678                        | 8,128         | 12,680      |
| Selukwe ... ..    | 21,231        | 9,686                         | 2,366                                          | 303          | 2,089                        | 3,439         | 3,348       |
| Insisiza ... ..   | 50,352        | 22,273                        | 5,902                                          | 640          | 4,958                        | 2,685         | 13,894      |
| Gwanda ... ..     | 38,675        | 19,389                        | 3,683                                          | 539          | 2,101                        | 941           | 11,962      |
| Belingwe ... ..   | 29,974        | 14,748                        | 3,040                                          | 368          | 2,148                        | 2,006         | 7,664       |
| Victoria ... ..   | 42,317        | 18,538                        | 5,309                                          | 380          | 3,717                        | 4,385         | 9,938       |
| Chilimanzi ... .. | 37,460        | 18,458                        | 3,451                                          | 440          | 3,219                        | 2,159         | 9,733       |
| Hartley ... ..    | 68,857        | 31,131                        | 9,007                                          | 851          | 7,537                        | 7,555         | 12,786      |
| Lomagundi ... ..  | 41,709        | 18,696                        | 4,889                                          | 442          | 4,296                        | 7,129         | 6,257       |
| Mazoe ... ..      | 46,723        | 17,252                        | 4,827                                          | 390          | 3,440                        | 13,553        | 7,261       |
| Salisbury ... ..  | 59,087        | 22,078                        | 6,307                                          | 397          | 5,393                        | 9,376         | 8,646       |
| Marandellas ...   | 32,368        | 15,425                        | 4,443                                          | 439          | 3,337                        | 4,679         | 4,039       |
| Charter ... ..    | 33,536        | 15,831                        | 3,918                                          | 477          | 3,085                        | 3,445         | 6,780       |
| Guta ... ..       | 14,519        | 7,263                         | 1,819                                          | 195          | 1,437                        | 1,135         | 2,682       |
| Ndanga ... ..     | 7,176         | 3,527                         | 790                                            | 73           | 692                          | 709           | 1,385       |
| Chibi ... ..      | 84,939        | 37,271                        | 10,859                                         | 1,125        | 10,459                       | 948           | 24,268      |
| Bikita ... ..     | 9,110         | 3,627                         | 1,091                                          | 114          | 1,831                        | 268           | 2,179       |
| Melsetter ... ..  | 24,399        | 12,154                        | 3,005                                          | 313          | 2,081                        | 1,560         | 5,286       |
| Umtali ... ..     | 28,703        | 13,792                        | 3,539                                          | 453          | 3,424                        | 2,814         | 5,176       |
| Makoni ... ..     | 34,153        | 16,379                        | 4,611                                          | 420          | 3,600                        | 3,505         | 5,629       |
| Inyanga ... ..    | 4,797         | 2,142                         | 649                                            | 69           | 538                          | 436           | 959         |
| Mrewa ... ..      | 4,977         | 2,280                         | 682                                            | 44           | 470                          | 696           | 805         |
| Mitoko ... ..     | 1,566         | 835                           | 160                                            | 20           | 81                           | 71            | 399         |
| Darwin ... ..     | 2,038         | 1,061                         | 193                                            | 20           | 271                          | 266           | 227         |
| Totals ... ..     | 936,251       | 429,941                       | 110,101                                        | 11,056       | 93,431                       | 95,192        | 193,530     |

**Animal Products.—Eggs.**—The figures given under this heading cannot be taken as the total eggs sold, for the same reasons as those given in respect of poultry. The total number is shown as 193,347 dozen, which is 20,431 dozen less than 1921.

**Cream.**—The quantity of cream sold as cream was 204,034 lbs., and as butter fat 168,091 lbs., which, reckoning cream as 40 per cent. butter fat, makes the total cream sold 624,261 lbs., as compared with 833,507 lbs. in 1921. This decrease is not surprising in view of the conditions prevailing during 1922. The low price paid by the creameries for butter fat has also had its effect, as it will be noticed that the production of farm butter has increased. At the price offered it evidently paid the farmer better to make and sell his own butter than to dispose of his cream to the creameries.

**Milk.**—Milk sold amounted to 3,666,702 lbs., as compared with 4,351,485 lbs. in 1921. Despite the drought, to which the decrease is attributed, the quantity sold was still 1,000,000 lbs. above the 1920 figure.

**Butter.**—The total farm butter sold was 292,964 lbs., an increase of 37,860 lbs. This, the only increase shown in animal products, is probably attributable, as stated above, to the low price to be obtained for cream from the creameries. The total butter produced by the creameries was 282,850 lbs., making a total in all of 575,814 lbs. The exports were 277,700 lbs., and imports 172,225 lbs., as against 421,815 lbs. and 84,497 lbs. respectively in 1921.

**Cheese.**—The cheese manufactured on farms during the year was 39,333 lbs., as against 41,854 lbs. in 1921. The difference is small and undoubtedly due to the drought. There is considerable activity in this branch of the industry, and with the favourable season, the amount manufactured this year will probably show a large increase. The imports during the year amounted to 114,632 lbs., valued at £6,007. and of this amount 110,931 lbs. came from the Union of South Africa. With the increased activity reported in the making of farm cheese, the local market will soon be fully supplied, and the problem of a market for the balance will then arise.

**Wool.**—The wool sold during the year was 16,914 lbs., an increase of 2,507 on the 1921 figure of 14,407.



## SOUTHERN RHODESIA.

# Report of the Director of Agriculture

## FOR THE YEAR 1922.

*Conditions in 1922.*—As compared to the previous year, when natural conditions were propitious and economic factors adverse, the position in 1922 was in both respects against us, drought and a partial famine being superadded to extension of the world-wide depression. After a promising commencement, the rains broke off, except for a little in February, and the country received only 40 to 50 per cent. of its normal rainfall, an altogether unprecedented state of affairs. It was most fortunate that the drought only set in about the New Year and not immediately after the normal dry season, which would have been much more serious. As it was, veld was abundant, some water had collected, and an opportunity was given for provision to be made against the winter, which also fortunately proved exceptionally mild. Despite adverse conditions, crops did well in places, and enhanced values of maize made up largely for lack of returns, especially since local prices are much higher than could be expected for any surplus sent overseas. Yields of all crops were about one-half of normal, except tobacco, which suffered least for want of rain and presented a happy contrast to the rest. Cattle continued saleable only at very low prices, and butter had the unfortunate experience of being scarce locally and cheap in the world's markets.

Compared to droughts in former years, there does not appear to have been nearly the same necessity as formerly for stock to be moved away, and although, of course, this did happen to some extent, yet it was not very general. As before, special rates were given by the railway for stock moved on this account, and grazing on unalienated land was allowed. A scare on this head was raised, but it did not appear that there was need of Government intervention, and this view was justified by events. The good start of the rains in the early part of the season provided sufficient grass in most parts of the country, and early rains in October, fortunately, relieved the situation and saved many thousands of lives. It is in such a season that the evils of kraaling and the need of fenced farms are most felt. The losses of stock have by no means been as great as in other years, except where veld fires, lack of precautions or quarantine measures have added to the shortage of water.

It was a noticeable and highly creditable fact that in the face of these adverse circumstances the farmers of the country have shown

a more than wonted activity in the way of permanent improvements and development. Labour was exceptionally abundant, and the normal work being largely in abeyance, the opportunity was largely taken of making bricks, building houses, sheds, dipping-tanks, kraals and stock-yards, constructing roads, dams, canals and silos, fencing, sinking wells, clearing scrub, and in other ways preparing for the better seasons which are confidently awaited.

The new season has commenced most favourably, and many of the farmers' requisites have now fallen in price; but there remains much anxiety as to when the improvement in regard to markets will commence.

*Markets.*—To secure markets for the products of our industry, the first essential is that the quality shall be sufficiently good and, if possible, better than that of other countries. Good things sell themselves, and quality is the best advertisement. To cheapen the processes of production and to increase the yield are equally important.

The development of markets is a commercial undertaking in which Government can no doubt give valuable indirect assistance. To sell the finished goods is not the function of Government, but the collection and dissemination of information on the subject may be most helpful to the mercantile portion of the community as well as to the prime producers. As examples of work of this nature conducted by the Department of Agriculture in the past may be mentioned enquiries in regard to markets for our meat, the system of maize grading, supervision of the handling of tobacco in the warehouse, help in regard to export of butter, promotion of egg circles, investigations in regard to oranges in London, California and the Congo, and personal investigations made public in regard to handling of maize, outlets for ground-nuts and other oil crops, and the possibilities of certain other crops. During their leave of absence officers of the Department have in recent years studied markets in Europe and made enquiries in regard to production in rival producing countries. Information of value has been brought back and turned to account in regard to all the above mentioned subjects. Representatives of our co-operative societies and commercial men on their own behalf have done likewise. It is felt that more is to be gained by enquiries of this nature, and in respect of certain particular commodities, by specialists conversant both with the question and with Rhodesia visiting the chief countries of production and consumption, than by either the alternatives of importing experts from other lands to advise us—as has occasionally been done in the past—or by employing one agent to glean technical details in regard to all industries, and open up markets for all our products, residing permanently outside this country. In exceptional circumstances there may be reasons to adopt these latter courses, but on our present scale of production the best results generally are likely to follow from investigations by our own experts, in Government employ or otherwise, into particular problems with which they have Rhodesian experience, to collect information for us and to bring back the best and latest ideas from other lands.

The English merchant and manufacturer in need of new sources of supply seldom looks beyond Mark Lane, Smithfield, Covent Garden or the other particular market which he has been accustomed to regard as the *fons et origo* of all his requirements, and certainly seems to omit Southern Rhodesia from his field of enquiry. Instead of seeking what he wants in the countries themselves where they grow, especially if they belong to the British Empire, he demands that everything shall be brought to his door. Not only samples and exhibits must be brought to him, but the bulk also must be landed, in London by preference, before purchase can be considered. This system throws a great part of the work of distribution on to the producer, who, especially in young countries like this, has at his disposal few or none of the trade facilities which the man of commerce can employ. Hence the processes of production are impeded, to the disadvantage alike of producer and consumer. No preferential consideration appears to be given to the colonist or settler in the self-same British Dominions which are asked to show a partiality for goods manufactured in the British Isles.

¶ The possibilities of the Congo as a market for products grown by the farmers of Southern Rhodesia deserve much greater attention than they have as yet received from our producers and middlemen alike. This country possesses, save for Northern Rhodesia, exceptional geographical advantages over the rest of the world in respect to the great and growing Katanga markets, and has, further, the advantage over Northern Rhodesia of production on a larger scale in a country of greater economic development and organisation, rendering cost of production cheaper. This trade has not yet been developed as far as it might be, and has largely been left to the more remote Union to enjoy. It is, therefore, of note that the year 1921 saw the commencement, after prolonged negotiations and subject to most stringent and irksome safeguards to the intervening country, of an export trade in slaughter stock to Elisabethville. Limited as to season, and hedged round with precautionary restrictions, it has yet been made possible for live cattle now to be conveyed by rail through Northern Rhodesia to the Congo territory. The present market is small, but with the anticipated progress and development of that region, there is reason to hope that ere long a considerable trade to meet the requirements there may arise and the existing difficulties may be overcome. In the same way there is a growing export trade in eggs and butter to the north, and room for private enterprise to send oranges and even grain and local manufactures to the Congo.

*Legislation.*—Little legislation directly affecting the farming community was passed in the Legislative Council during the year. Only one measure, the Native Labourers Compensation Ordinance, seriously affects farmers, by providing that that law shall apply in the case of all work on farms, just as on mines and railways, in factories and workshops.

The Angora Goat and Ostrich Export Prohibition Amendment Ordinance merely cancels, in respect of Angora goats, but not of ostriches, a law passed in 1907, prohibiting their export to certain countries, which was adopted here in deference to the wishes of the

Cape Parliament, and has now been altered at the request of the Union Government. It in no way affects local interests.

*Cattle.*—The increase of cattle has been much less than in any previous year of which we have records. The birth-rate has been sensibly affected by the drought and by contagious abortion, whilst the death-rate from quarter-evil, poverty and coast fever has no doubt been heavy. The number of cattle at the end of 1922 is therefore rather less than was anticipated, the European-owned cattle being approximately 940,000 head, and those owned by natives about 865,000, giving a total of 1,805,000 head. These numbers compare favourably with each of the four provinces of the Union of South Africa, and with Victoria, South and Western Australia, and Tasmania.

The cattle industry of Rhodesia is in a grave predicament, and as cattle continue to increase and the prospect of markets does not improve, but rather the reverse, the position is rapidly becoming acute. The cattle owners and the Government alike are anxious to ameliorate the present state of affairs by finding means whereby Rhodesia may be made sufficiently attractive to those able and willing to convert our cattle into products saleable to-day in the markets of the world. Realisation of the position led the Government to appoint a Committee of Enquiry to investigate the problem and to make recommendations with a view to securing markets at the earliest possible date. Whilst the position of the cattle industry is well enough known and understood by cattlemen in Rhodesia, it is hoped that this Committee will serve a good purpose in bringing to a focus the views of all concerned. It may be instrumental in calling the attention of those associated with the meat trades in other parts of the world to the special attractions in this respect which Rhodesia has to offer. The terms of reference include—

- (a) the quantity and quality of cattle available for export now and in the future;
- (b) the markets to which the industry may look for the disposal of such surplus;
- (c) the best means of encouraging and developing export to such markets; and
- (d) generally, as to the prospects of the industry and the possibilities of improving the position in regard thereto.

It is to be remembered that the present phenomenal depression of the cattle market is world-wide; it is not peculiar to Rhodesia or South Africa. There is reason to believe, however, that it is a passing phase, and that the world's markets are quite likely to be restored and active before the industry is so organised in this country that advantage can be taken of its recovery.

Owing to economic causes, the ability of a large section of the meat-eating population of the world to purchase their requirements is indefinitely suspended, but sooner or later it must return to normal, and the fundamental truth remains that there is a shortage of meat to feed those nations that want it. Actually the recent increase of consumers or potential consumers of meat has been even greater than the development of new sources of supply. For the time being, how-

ever, the collapse of the market is very real, and its effect on the cattle owners of Rhodesia little short of disastrous. The Odzi Canning Factory recommenced operations, trusting, at the prevailing low prices, to be able to provide an outlet for some of the stock of its members, but found it necessary after a few weeks to again close down. The export of slaughter cattle to the Rand in 1922 was, according to Customs figures, 19,405 head, as against 8,965 head in 1921 and 24,142 head in 1920. The average value was only £5 3s. 1d., as against £8 12s. the previous year. Railway rates have been reduced, but other charges remain high, and this market cannot be regarded as a reliable or permanent one. Rhodesia is the most remote of the sources of supply, and it is, therefore, the first to suffer when meat can be procured in sufficient quantity from nearer points. In any case the distance and duration of the journey to that market from Rhodesia tells seriously against the condition and weight of the carcass when it arrives in Johannesburg. Owing to these disadvantages the Rand can only be regarded as an outlet for us until a better one arises. Moreover, with the development of the cattle industry nearer that centre, Johannesburg is likely ere long to cease to require our cattle at all. So far the Congo market has not proved all that was hoped, but it is capable of expansion. Portuguese East Africa draws small supplies from Rhodesia, the total for the year being 1,407 head of mixed stock.

The need of good bulls is on all hands recognised, and the increase of pedigree herds in the country is a good sign. The number of cattle returned by farmers as pure, not necessarily pedigree, has risen from 8,748 head at 31st December, 1921, to 9,224 head a year later. On the other hand, we regret to find, no doubt owing to want of ready money, that the importation of pedigreed stock, bulls and cows, from the Union, which had for the preceding three years been successively 789, 932 and 1,006, fell last year to 710 head, whilst the returns of pedigree cattle from the United Kingdom have been steadily dwindling since 1917, when they were 199 head to only 21 last year. This appears the more serious when the rapid rate of increase of cattle generally is remembered. It is recognised that improvement of quality is essential, but the means are not here. Without good bulls the provision of sufficient improved cattle to warrant export is impossible.

*Dairying.*—The drought had a most adverse effect on the dairy industry, coupled as it was with a simultaneous fall in the world's prices for butter. Previously dairying had been making rapid strides, and with the termination of the drought it has again recovered ground, the quick returns furnished by the creameries being a great incentive in these times of cash shortage. At one time, with low prices and lack of feed, milking operations were suspended, and the factories were faced with a period of much diminished production but undiminished overhead charges. Happily these conditions did not last too long. The need of providing winter feed and making provision for scarce times has been brought home to farmers in a fashion they are likely to remember, and there is a noticeable demand for guidance in regard to plans for cow stables, silos and hand feeding.

There has been a number of notable importations of dairy stock

from the Union, both direct and through the agency of the Friesland Breeders' Association of South Africa, a tangible indication of confidence. Attention too is being given by dairy farmers to systematic observation of the productive capacity of their cows by means of milk records which, initiated by the Dairy Expert, are proving of much instructive and practical value.

Cheese-making is becoming more popular, and cheese of excellent quality is produced. Instruction in cheese-making is being given all over the country under considerable difficulties, in view of the distances between producers, the make-shift accommodation available, the incidence of the rains in the busy season and the lack of knowledge on the part of those endeavouring to take up, without any preliminary training or apprenticeship, a somewhat difficult manufacturing process requiring skill and experience. In spite of these manifest drawbacks the Dairy Expert is able to report that very good saleable cheese is being turned out, and that the day is not far distant when all the cheese required for local consumption will be manufactured in the Territory, in spite of the fact that the standard of quality required for such products in this country is extremely high.

Owing to the unfavourable season our production of butter fell to one-half of that of the previous year, and, could this have been foreseen, it would have been better to have exported none, instead of 277,700 lbs., value £25,186, which left the country before the shortfall of the season was recognised. Towards the end of the year there were happily indications of a complete recovery of the position.

*Pigs.*—The drought and the high price of grain caused a shortage of pigs, with consequent high prices and lack of adequate supplies to the factories. Considerable interest is being shown in pig-breeding, and there is a marked improvement in quality, so that there is every reason to anticipate progress in this direction in the coming year.

*Poultry.*—This branch of the farming industry can happily record marked expansion, and is from year to year growing in importance. Poultry keeping appeals very strongly at the present time, for the reason that it can be made to bring in quick returns in cash, and is capable of being conducted on any scale from that of a domestic concern to a major branch of farming. Local needs are far from satisfied, and there is a ready market in the Congo. There are now a considerable number of persons devoting attention to poultry, keeping upwards of 1,500 birds, whilst many farmers have 500, and plot-holders near towns often keep 750 birds and depend on them for their living. As the industry is young and growing there are still many novices, and these, as well as the established poultry keepers, require much personal assistance and advice. A second expert was appointed during the year. There is much scope for instruction by lectures, demonstrations and visits, as well as for commercial organisation. Egg-laying tests, combining the advantages of instruction, demonstration, competition and advertisement, have been continued, with good results. The poultry shows, and the educational exhibits made by the poultry experts there, have been most successful. That held in conjunction with the Bulawayo Agricultural Show claims that in the past two years it has offered

prizes of a higher aggregate value than any other poultry show in the world. Special attention has been devoted to certain classes of poultry raisers—the producers on a commercial scale, the small holders round towns, the recent settlers, the railway workers, and especially, with the kind co-operation of their teachers, to the children, whose interests are awakened at an impressionable age.

Egg circles are in process of formation, the first having been successfully launched at Gwelo. As in all such efforts, there are in the early stages many difficulties, but these are being overcome, and there can be no doubt that in co-operation of this sort lies the key to stable development of the industry, to fair returns to producers and reasonable prices to consumers. It is to be regretted that, owing to past failures, arising from diffidence amongst producers, and a desire not to make success but to share in it only when made, there has been considerable hesitation in joining these egg circles, which, if loyally supported, must be of incalculable good to the individual and to the country at large.

For the first in history the value of our exports of eggs, according to Customs returns, exceeds our imports, although curiously enough, in numbers imports are still greater than exports, an inferior cheap class evidently being brought in.

*Crops.*—The yields for the year were a reflection of the season, all much below normal. Acreage was less affected, as of course most sowing is done in the faith of a good season, and only certain crops can be put in so late that the prospects can be foreseen. The total acreage under European crops was 228,000, as against 241,862 acres in the previous season, which was a record one in every respect.

*Maize.*—Maize for grain, at one time almost the only crop, and still undoubtedly the principal one, now occupies less than four-fifths of the area under the plough, though maize for silage (with 5.4 per cent. of the total) brings it up to 85.1, the rest being devoted to thirty different crops, wheat first, tobacco taking next place, then ground-nuts, followed by potatoes, sunflowers, beans and velvet beans, all about equal and the rest in minor degree. The position of maize is still predominant, and in quality it is pre-eminent, but virtually none was exported last year, as the crop was all required for feeding to the natives in famine-stricken areas. In spite of the important position occupied by maize, it has come as somewhat of a surprise, as the outcome of careful analysis of returns, that comparatively few of our farmers are primarily maize growers. Only about 13 per cent. of the farmers were mainly dependent upon maize, and 6.8 per cent. of the whole farmers of the country grow 59.3 per cent. of the total maize crop. Further, it was found that 33.9 per cent. grew no maize at all. At present prices maize has to be grown on a large scale to pay and to enable economies in production to be applied. It is much to be regretted that we are still cut off by political causes from our best outlets, and that until European markets and exchanges improve we have little prospect of a ready sale for maize, either as such, or after it has been converted into more concentrated form in the process of fattening cattle.

The Rhodesian Agricultural Union at two consecutive Congresses has recommended legislation calculated to protect the growers of white maize against contamination, to which they are so readily exposed, by the possibility of cultivating in their vicinity mixed or yellow maize, and the subject has also been ventilated in the Legislative Council. It should not be beyond the wit of man to find a solution of the problem.

*Tobacco.*—The activity of the tobacco growers can be measured by the area planted, which last year reached the record figure of 10,174 acres. Owing to lack of rain this did not yield as large a crop as was harvested in the previous years, but the quantity is none the less considerable, amounting to 3,182,359 pounds, of which 2,888,104 pounds were Virginian and 302,255 pounds Turkish type. It may be mentioned that, as practically all this leaf is manufactured in the Union of South Africa, it brings in an excise revenue of about £50,000, to that country's exchequer, whilst the value of the leaf exported from Rhodesia is given at £156,163 for purposes of Customs valuation.

As was pointed out by the Tobacco Expert last year, the full amount which can be consumed within South Africa is now being produced, and if the output increases oversea markets must be found. Small quantities are unmarketable, however, in this way: sufficient of one character must be grown to enable a brand to be established. Experience has shown that the preference of one penny an ounce is not adequate to enable markets for Colonial leaf to be established in England with any benefit to the producer, and steps have been taken to secure that this matter shall be brought up for consideration at the next Imperial Conference.

The disposal of the tobacco crop of Southern Rhodesia is controlled by the operations of the Rhodesian Tobacco Co-operative Society, Ltd. Under an arrangement with the Government the Tobacco Expert has acted as supervisor of the warehouse for some time, but this has now terminated, relieving him for much-needed advisory work amongst the growers. The pooling system of handling ungraded tobacco and the valuation of leaf upon receipt at the warehouse was continued last year. The directors of the Society have now decided that all tobacco must be properly graded upon receipt at the warehouses, instead of being handled there as hitherto. The system of selling tobacco under contract still continues in force. The Society has recently entered into fresh arrangements with the principal buyers for a period of three years. The prices fixed are such that the growers of good tobacco will receive fair returns for their capital and labour.

In the absence of a much-needed Government experiment station for tobacco, arrangements were made on a limited scale for conducting such work at Virginia, Mazoe, the funds, lands and equipment being generously provided by the Commercial Branch of the British South Africa Company. The experiments include variety tests, fertiliser experiments and commercial plantings, and the results will in due course be available to the public. The opportunity has also been taken of arranging at the same place for certain experiments in cotton growing.



In the year under report no wild fire nor angular spot disease was observed in Southern Rhodesia, although it was prevalent in the Union. A large quantity of seed was treated with formalin, and in the process all inferior light seed removed, a double advantage which appears to be having beneficial effects.

*Wheat.*—Wheat, owing to the drought, was grown on a much less acreage than previously, and, even so, unfortunately much failed owing to lack of moisture in the winter vleis where it is chiefly grown. This loss was supplemented by the unprecedented ravages of small birds, driven apparently far afield from their usual haunts by lack of wild food. Myriads of birds appeared and devastated all that was left of the wheat lands. Add to this, low prices and lack of protection against dumped Australian wheat and flour, and the wheat growers confess to a discouraging year. However, with a return to normal, there is every prospect of this crop continuing next in acreage and importance to maize, a fact hardly adequately realised as yet.

*Other Crops.*—Ground-nuts, a leguminous crop valuable in rotation and useful as feed, exportable and for which a market exists locally for manufacturing purposes, is now one of our most important crops. It is drought-resistant, grows well on the sand and on the red soils, and earlier difficulties connected with cultivation and harvesting have been entirely overcome. There is a market for much more than is as yet grown.

There was a marked increase in the area under potatoes, particularly in the Salisbury district, but with an average yield of only 13 bags, against 26 the previous year, there appeared to be no glut.

Bean crops on an increased acreage were a failure.

Velvet beans, chiefly for fodder, are more and more coming into favour, the respective areas to this crop for the past three years being 581, 1,889 and 2,156 acres, with even more put in for the coming season.

Sunflowers deserve mention as a hardy, easily grown crop for which an overseas market exists, and which also has exceptional value in rotation with maize.

*Citrus.*—Important progress has been made in connection with the orange industry. Exports amounted to 24,000 boxes, against 18,000 last year, and are likely, from trees now coming into profit, to approach 60,000 boxes next year. The average price in England amounted to about 19s. 6d. per box, which is less than last year; but prices fall in sympathy with values generally, and several very material economies have been effected in regard to shookwood, railway rates, ocean freights and expenses connected therewith.

Whilst by combination and agitation the external charges have been brought down, there would still appear to be room for the growers to improve their own methods and evolve internal economies also. In certain of our citrus propositions the expenses appear to be inordinately heavy, and it is in this direction especially that improvements are to be looked for in the future.

Although the production of oranges in Rhodesia is expanding, and must continue to do so for several years from trees already planted, there has not been that extension of new groves which might have been expected. Owners of suitable ground for citrus planting, and there are many such with much land, seem to be waiting to see the results of the pioneers in this direction before committing themselves to the considerable capital outlay connected with the necessary irrigation works, construction of buildings, formation of groves, and so on, and facing the necessary period of waiting until the trees come into bearing. This attitude must affect future expansion of the trade, but there does not, from a cultural standpoint, appear to be any justification for this hesitancy.

Citrus culture cannot be recommended to those in need of quick profits, for it is not a hand to mouth business; but for those who are prepared to invest money and await results, or are in a position to pay others for having done so in years gone by, it is recognised that citrus farming in Rhodesia, on a small or a large scale, offers very great attractions and the prospects of handsome returns. By growing crops between the young trees land can be turned to profitable account to some extent, so that the land during the period till the trees are in profitable bearing is not wholly unproductive.

Southern Rhodesia has been fortunate in that it has been able to co-operate with the Union, to the advantage of both countries, in the organisation of the Fruit Growers' Co-operative Exchange of South Africa, Ltd., which during the year has become an accomplished fact, and which has already been instrumental in helping citrus growers in several very material ways. The Citrus Adviser has been active in the interest of Rhodesia in this connection. A Rhodesian Co-operative Fruit Growers' Association, Ltd., affiliated to the Exchange, has been formed. Great improvements in connection with the despatch of fruit to the coast, inspection, storage and prompt shipment have been effected. Through these bodies, representative of the growers of citrus and deciduous fruits and pineapple throughout the sub-continent, supported by the Governments concerned, the export trade has been put in order, and much waste, overlapping and confusion obviated. The Exchange has only lately commenced operations, but it has already proved its beneficial effects to growers, Government and shipping companies alike. The initiation of this system has not taken place without many difficulties, but these have been successfully overcome, and the impending danger of a complete breakdown of the South African fruit export trade has been avoided and past confusion replaced by a system which is now running smoothly and satisfactorily. Improvements in shipping accommodation have been and are being provided. Fruit inspection is being carried back from the docks to the packing house and the groves, the right place; and the grades for export have, at the instance of the Exchange, been materially tightened up, an improvement at once appreciated and recognised by the trade.

It is to the credit of Rhodesian growers, and to the instruction given them, that none of their fruit was rejected on inspection at the docks. This is the more remarkable when it is remembered that

Rhodesian consignments have a journey of seven to eight days to Capetown, as compared to three or four days from the Transvaal, indicating clearly the excellent carrying qualities of our oranges when properly handled.

The Rhodesian Co-operative Fruit Growers' Association, Ltd., has also been instrumental, in conjunction with the Government, in securing reduction on railway rates in Rhodesia for box shooks and fruit for export, which in the aggregate are material.

*Research.*—The justification for research by means of experiment farms has been well stated by Mr. J. A. T. Walters, one of the Agriculturists, as follows:—

“Agricultural science in a new country like ours is a creature of slow growth. It is based on research, which depends for its progress on experimentation. Such experimentation in an extensive territory must be as wide as possible. The basis of this work is necessarily the experiment stations, where problems are studied under the eye of the trained observer. As results are reached their application to diverse conditions is tested by co-operative experimentation in which the individual farmer assists.”

Such, in brief, is the system which has been followed in Southern Rhodesia, and it is well in the midst of the study of the problems to remember the policy of which they form part. Research is the keynote of the work of the various branches of the Department of Agriculture, whereby its specialists are enabled to gain information and so give advice on the manifold questions which are continuously put to them. From the results of these various experiments a store of experience is being built up, transferring our ideas in regard to farming from the realm of fancies to the region of certainties, and replacing theory by demonstrated fact. The lessons learnt are reflected in the farming practice of the country, which is advancing continuously and rapidly in every direction.

The Government Experiment Farm, Gwebi, has continued its activities, and the results for the year have been duly published. Much has been accomplished in spite of the lack of equipment. Improvements have been effected in regard to roads, fencing and native compounds, but no development involving capital outlay of any consequence has been possible.

The Experiment Station at Salisbury has now completed its fourteenth, and, so far, its busiest year. Over 350 plots are now under cultivation, and close on two hundred parcels of seed were received for new sowings of various kinds from outside. A large number of potential new crops are being tried, from amongst which there emerges every now and again something worth special attention and more extended trial elsewhere. As illustrations of such promising novelties, at the moment may be mentioned new varieties of velvet bean and dhal, and certain indigenous species related to beggar weed, to sunn hemp and to couch grass. Of minor crops, the cultivation of peppermint and coriander is also worthy of attention. Experiments in soil exhaustion

and maintenance of fertility have now reached their tenth successive year, and have arrived at a stage when valuable deductions can be drawn in regard to methods of rotation, green manuring and soil enrichment.

The sand veld experiment station of Arlington provided by Sir H. Wachter was, at his request, discontinued; the work commenced, which was of distinct potential benefit to farmers on our granite soils, was thus lost.

The recently established Experiment Station at Bulawayo, operated by the Municipality in conjunction with the Government, has on the other hand proved a benefit to farmers. Crops new to the district were successfully grown in spite of a rainfall of only 13.5 inches, of which 4 inches fell subsequent to planting. The area has this season been increased by one half, bringing it up to thirty acres.

The experiment stations are virtually field laboratories, and, to bring home to the farmers the results of this work, which but few can personally inspect, reports in the *Agricultural Journal* and Press are issued and the subjects discussed at meetings of farmers' associations, and whenever opportunity arises. The free distribution of seed and plants of new crops or new varieties of old crops is readily taken advantage of, and last year free issues of 105 different varieties of seeds or plants were distributed. The special investigation in regard to magnesian soils was continued on Mr. E. J. Smith's farm Cromdale, Makwiro, but the dry season was unfavourable, and it will be carried on for another year to ascertain the residual effects of applications given. Rotation experiments are in progress in conjunction with Mr. A. R. Morkel at Ceres, Shamva, which necessarily will take a series of years to complete.

Special investigations in connection with the study of problems connected with the cultivation of maize are being continued with seventeen members of the Maize Breeders' Association. A supply of the "Capex" brands of fertilisers, materially assisting the carrying out of these experiments, was generously provided by the manufacturers. The valuable experiments undertaken by Mr. H. B. Christian at Ewanrigg in connection with the fertilising value of wood ash and green manures deserve mention. The South African Breweries are doing much to encourage the growing of barley on a commercial scale and to extend its trial with a very considerable measure of success. The very dry season unfortunately told against the success of this experimental work to some extent.

*Botany.*—The appointment during the year of Mr. F. Eyles, F.L.S., as botanist and micologist, marks an important step in strengthening the scientific staff at the disposal of the farmers. Botany is obviously the mother science of arable farming, and the turning to account of the natural vegetable products of the country opens wide doors for economic progress. The study of vegetable pathology is essential, for by combating disease amongst our crops not only are grave losses prevented and profits increased, but the quality of our commodities is improved. There is need for the study of the diseases

of tobacco, maize, potatoes, onions, citrus and other fruits, and to guide farmers in dealing with them. A herbarium, especially of economically important plants, is essential in a young agricultural country such as this, and such a collection can now be supplemented by the recently established botanical garden, for Rhodesian flora only, in Salisbury.

*Forestry.*—The acquisition of the Mtao Reserve, and the commencement there of systematic tree planting on a large scale, constitutes a first step in the creation of state-owned forests and plantations on a commercial scale, the plantations at the Gwebi, the Forest Nurseries, Salisbury and Inyanga, being primarily of an experimental character. The area which was, after prolonged search, recommended by the Forest Officer for this purpose and approved, consists of 13,137 acres of previously unalienated land lying on the Gwelo-Victoria line, some twelve miles south of Umvuma. Since 1910 it has been a reserve on which the cutting of timber was prohibited, a regulation which unfortunately was not always respected. The necessary buildings have been erected, wells sunk and a nursery established to provide trees for these plantations and for farmers in the midlands and south-eastern districts. It is intended, in addition to exotics, to plant such indigenous trees as are likely to respond to artificial treatment and to turn to account the existing native timber.

The supply of trees and shrubs from the Government Nursery at Salisbury continues to receive active support from the public, the proceeds of sales for the year amounting to £1,226 16s. 8d., the highest return yet obtained.

During the year the natural vegetation was studied by the Forest Officer in the Sebungwe district to the Zambesi Valley, in the eastern highlands above Umtali, and in Marandellas and Chilimanzi, with special regard to tree growth. Interesting observations have been recorded which will lead in time to a better understanding of the sylvicultural possibilities of the country. An increasing interest in the protection of our native trees and in the possibilities of tree planting is observable in all directions.

*Chemistry.*—All the allied sciences concerned with agriculture are inextricably connected with chemistry, and necessarily seek its aid in the elucidation of problems connected with daily farm practice, such as manuring and cultivating land, feeding of stock, dairying, spraying of fruit trees, dips and poisons and a wide variety of kindred details. The routine examination of specimens takes up much time, but research is also undertaken as far as possible. An examination into the composition of a number of the principal Rhodesian grasses was carried out, and the results have been published. There is need for further investigation in this direction. By the training of cattle inspectors to ascertain the strength of dip, the chemists have been relieved of much routine work, though some supervision is still exercised over this subject by examination of samples from time to time where occasion demands. The control of the composition of fertilisers has involved more work than in past years. This article before the war was largely used, but since then the demand fell away. The prices for artificial fertiliser

having now fallen, it is again being used more largely for tobacco and even for maize also. Comparative tests of a number of fertilisers are being conducted at the Salisbury Experiment Station and the Government Farm, Gwebi, also certain pot culture experiments.

Soils, limes, waters, dairy products and miscellaneous samples were examined, and a considerable amount of time was devoted to examination for poisons in specimens submitted by veterinary surgeons, the cause of death being in many cases determined. On behalf of the Government of Northern Rhodesia, examination for alkaloids was made in connection with the death of valuable cattle imported into that country.

*Entomology.*—Research work of a most valuable character, in addition to routine duties, has been carried out by the entomological branch in many different directions.

Tsetse fly, though comparatively little known, is probably by far the most serious menace to the country at the present time, preventing as it does the occupation and development of wide regions on account of the diseases of man and beast which it conveys. Unfortunately, it is year by year spreading, and though as yet hardly encroaching upon occupied country, it is getting nearer to the outlying farms. Wherever conditions favour fresh country being occupied, the entomologists, not without some personal risk, have devoted much attention to this danger, and have acquired a good knowledge of the bionomics of the insect, although much remains yet to be learned. Important investigations of the life history, habits and especially of the natural enemies of the tsetse have been conducted by the entomologists, and most important observations made which, however, must be continued and extended.

The game elimination experiment after four years was brought to its logical conclusion. With the nearly complete disappearance of the game from an area originally containing much game and fly, the tsetse also diminished to a very marked extent, whereas game and fly alike increased in areas immediately adjacent. As the Chief Entomologist says:—

“As far as a single experiment can prove anything, the present one may be regarded as having demonstrated the dependence of the fly on the larger mammalian fauna of this locality. As a result, we are encouraged to proceed with measures aimed at checking the continued advance of the fly, based on the principle of control of the prevalence of game animals.”

Applying these lessons, a cordon nearly 200 miles long was drawn from the Zambesi River to a point near Gokwe, consisting of a belt in which special facilities have been granted individuals to shoot out all wild animals, thus creating a buffer between the fly-infested areas and the occupied districts of Wankie, Nyamandhlovu, Bubi and Gwelo. So far as can yet be judged, the plan has worked well, and will be repeated next season. To throw open to unrestricted shooting the whole Sebungwe district would involve unnecessary destruction of animal life and not protect the inhabited country against the fly as effectually

as will concentration of operations along the boundary of the fly belts. Incidentally, it may be observed that the slump in the value of cattle has reduced the demand for biltong so much that hunting has already ceased even in the open area in the Hartley district. A marked increase of big game has been observed in certain districts, viz., Lomagundi, Darwin and Umniati, and here the extension of the fly belt has also been particularly noticeable.

Insects injurious to maize have received much attention from the entomologists, particularly in respect to those known as the black maize beetles, snout-beetles, stalk-borer and the pests of stored grain. The citrus scales, aphides, thrips and codling moth have been given special attention and good progress made, if no conclusive results yet attained. Such investigations are amply justified by the extent of damage caused, particularly in precluding otherwise good fruit from being marketable and in diminishing the crop, in spite of favourable conditions in every other respect.

The pests of cruciferous, leguminous and cucurbitaceous crops have been studied and useful additions made to our knowledge of these subjects. In the study of economic entomology time is necessary for complete knowledge to be gained, and not in every year can additions be made. Exceptional seasons, dry or wet, materially interfere with such work.

There is reason to be thankful that the visitation of locusts proved brief and harmless and that they have not reappeared. All preparations that could be made in advance were provisionally arranged, and should it be necessary the measures provided for under our locust laws can at any time be set in motion at short notice. With the adjacent territories of Bechuanaland and the Transvaal seriously infested, we have, so far, been extraordinarily fortunate in escaping invasion.

*Meteorology.*—Seasonal forecasts are now attempted on the basis of information collected from other parts of the world, but it must necessarily be a matter of years before a high degree of reliability or accuracy can be looked for, when a greater number of factors influencing our weather can be taken into consideration. We are reciprocating with other countries in this connection.

For the benefit of arable farmers, more especially of tobacco growers, daily forecasts were issued during the planting season, commencing on 1st November, sent daily at noon to Mazoe, Glendale, Norton, Lydiat, Banket, Wellesley, Darwendale, Inoro and Rusape, covering the following 24 hours. These forecasts have proved fairly reliable, considering that this was the first season, and there is no past experience to work on. The need, however, is apparent for data from stations further east than Beira. A condensed weekly weather report is issued to the Press during the rainy season, and a bi-monthly circular, re-published from the *Agricultural Journal*, is sent to interested quarters. Annual meteorological reports are compiled and issued as soon after completion of the year as possible. There are to-day 366 purely rainfall stations in the Territory, the daily precipitation being the information of greatest interest and most immediate concern to farmers;

also eleven second order and thirty-two third order stations for more comprehensive observation of meteorological conditions.

*Hydrology.*—The collection of hydrographic information makes progress commensurate to the funds available, but could usefully be extended. During the year eleven river gauging stations were installed, from which daily fluctuations in level are obtained. A number of other gaugings was taken in connection with allocation of public water for irrigation purposes and for experiments regarding the duty of water in citrus orchards.

The water courts dealt with 73 applications, for water, travelling 3,000 miles for this purpose, whilst 70 applications have been received and are awaiting attention. The total number of grants of public water made to date under the present water law is 159 in respect to 17,403 acres.

An important review of the hydrographic conditions of Southern Rhodesia, including an indication of the potential sources of water power, was issued by the Hydrographic Engineer, indicating close upon half-a-million horse-power at present unharnessed and capable of supplying energy when required.

The drought gave a stimulus to well-sinking and water storage which, though generally too late to be of much help at once, will no doubt alleviate conditions in the future.

*Irrigation.*—The irrigable area reported upon by the Government engineers in the past greatly exceeds that to which grants have been given, since it amounts to 32,638 acres, including 2,887 acres examined last year. Thus there appears to be a large extent of land known to be possible for irrigation, and which has actually been inspected for this purpose, for which as yet no water rights have been secured. Some of this land, of course, will be irrigated by private water which requires no allocation, but not all; and it would appear, therefore, that much land known to be suited to irrigation is not being so utilised, nor are steps to that end being commenced. As the occupation of the country extends to lower levels where the rivers are bigger and the rainfall less, irrigation is likely more and more to come into operation for the development of the country by the cultivation of alluvial plains in the hot valleys of the Sabi, Limpopo and Zambesi and their tributaries.

There is a constant and increasing demand on the part of farmers for advice in laying out irrigation schemes and in regard to erosion, drainage, sites for wells and boreholes, and the erection of dipping tanks, water tanks, silos and other farm structures.

For the first time since the present water law came into force, a sum of £5,000 from the loan funds was made available to farmers. Applications received have exceeded this amount, but unfortunately under existing financial conditions no further funds are for the time being available.

Much attention has been devoted during the year to helping natives in their reserves to obtain reliable underground water supplies for



their increasing flocks and herds and for domestic use, without which they cannot turn to full account the land they occupy. The need for this is permanent, but owing to the drought it became very apparent last year, and schemes of systematic well-sinking and provision of pumps and storage were pressed forward as matters of urgency. They will, however, be of permanent benefit to the country. It will take several years to complete the provision of water supplies in the native reserves.

*Pounds.*—The number of pounds has been reduced by one to forty-nine. The question of amendment of the pound system has been engaging attention throughout the year, and the subject is still under consideration.

*Brands.*—The total number of brands registered is 8,338, 281 having been added during the year.

*Vermín.*—The destruction of baboons by organised hunts has proved successful, 1,647 head having this year been killed by this means, the largest number yet brought to book in one year. Wild dog is the only form of vermin for which rewards are given. With the increase in live stock more is heard of injury from this cause, and also from lion, leopard and snakes.

*Departmental.*—As this is most probably the last complete year for which a report will be called for upon the working of the Department of Agriculture, as constituted under the *regime* of the British South Africa Company, it is perhaps fitting and of interest to record its growth and progress.

Originally combined with sections of Government connected with land sales, land survey and other matters, the Department took form in 1903 under a Secretary for Agriculture (Mr. Ross-Townsend), who, in 1908, relinquished the office, when the system now in force came into existence. At that time, apart from the Veterinary Department, the technical staff consisted of a tobacco expert, an analyst and an assistant in charge of experimental stations. Growth in numbers is not necessarily a sign of increased efficiency, but in this case it may be claimed that every addition to the staff has been urgently needed, often long before it was provided, and that there has always been abundant work to justify each fresh appointment, a situation which exists to this day. It would be tedious to refer to each step in the evolution of the Department of Agriculture; suffice it, therefore, to say that to-day the staff numbers sixty, against nine in 1908, and that it is sub-divided into thirteen branches, whilst the administrative duties have expanded beyond all recognition in order to fulfil the aims of the Department in helping on the agricultural development of the country. The nature of the work of the Department of Agriculture demands a staff capable of dealing with the very varied aspects of farming, hence the relatively numerous branches which are occasionally criticised by the uninformed as superfluous. The personnel of each branch is by no means excessive in relation to the amount of work they are called upon to perform.

The branches of the Department with their technical staff are as under:—

|                                             |   |
|---------------------------------------------|---|
| Agriculture (arable farming) ... ..         | 9 |
| Chemistry ... ..                            | 3 |
| Entomology ... ..                           | 3 |
| Agricultural and Irrigation Engineering ... | 3 |
| Hydrographic Survey and Meteorology ... ..  | 1 |
| Botany and Mycology ... ..                  | 1 |
| Tobacco ... ..                              | 2 |
| Citrus ... ..                               | 1 |
| Forestry ... ..                             | 4 |
| Dairy ... ..                                | 1 |
| Poultry ... ..                              | 2 |
| <i>Rhodesia Agricultural Journal</i> ... .. | 1 |
| Rhodes Matopos and Inyanga Estates ... ..   | 5 |

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The administrative and clerical staff numbers twenty-four. The entire establishment is 54 on votes and six on the Rhodes Bequest. The vote for Agriculture, always kept to a bare minimum much below what might advantageously have been expended had it been available, and often not fully spent, has been as follows:—

| Year.          | Vote.   | Supplementary |              |
|----------------|---------|---------------|--------------|
|                |         | Vote.         | Expenditure. |
| 1906-07 ... .. | £11,910 | £1,003        | £13,113      |
| 1907-08 ... .. | 12,412  | 2,316         | 14,131       |
| 1908-09 ... .. | 11,433  | 150           | 9,471        |
| 1909-10 ... .. | 13,170  | 2,885         | 16,063       |
| 1910-11 ... .. | 25,166  | 500           | 17,088       |
| 1911-12 ... .. | 29,100  | 3,325         | 31,315       |
| 1912-13 ... .. | 22,559  | 2,350         | 23,370       |
| 1913-14 ... .. | 24,337  | 250           | 24,542       |
| 1914-15 ... .. | 23,693  | 300           | 19,282       |
| 1915-16 ... .. | 21,149  | —             | 18,266       |
| 1916-17 ... .. | 20,561  | —             | 18,566       |
| 1917-18 ... .. | 19,620  | —             | 17,630       |
| 1918-19 ... .. | 18,798  | 400           | 19,142       |
| 1919-20 ... .. | 26,173  | 2,850         | 28,998       |
| 1920-21 ... .. | 35,792  | 3,150         | 38,857       |
| 1921-22 ... .. | 39,321  | —             | 39,265       |
| 1922-23 ... .. | 42,968  | —             | —            |

The native hospital was at last removed from the building it had long shared with the Department of Agriculture, and the various offices are now concentrated in a way greatly assisting the conduct of work. Whilst comparing very unfavourably with corresponding public offices in other parts of the world, the recent improvements are yet a decided advance over past conditions.

Structural alterations at the Agricultural Laboratories, Salisbury, long required, have now been carried out, and these will greatly facilitate the work of the chemists, agriculturists and entomologists. The area of both experimental grounds provided by the Municipalities of Salisbury and Bulawayo has been extended.

## Tsetse Fly.

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### A FOUR YEARS' EXPERIMENT IN GAME ELIMINATION.

(Concluded.)

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By RUPERT W. JACK, F.E.S., Chief Entomologist.

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**Apparent Effect on the Tsetse Fly.**—As the operations continued the tsetse fly greatly decreased wherever comparative observations were made, and by October, 1922, it had practically disappeared from a considerable tract of country.

The portion of the area south of the Shangani River from Walker's Drift to "F Post" was the first to show reduction approximating to elimination. Very little fly was seen in this region after 1919. In that year a considerable number were present close to No. 1 Main Camp. As many as fifteen flies were seen at a time on the wet sand of the river by the side of a pool used for bathing purposes. Although the position of the main camp was changed next year, the old camp was still occupied by native hunters, but no fly have since been seen by the writer at this spot, although in December, 1920, the officer-in-charge reported that fly had put in an appearance here together with a number of waterbuck and impala. The shooting round the main camp in 1919 was, of course, very intense. A few tsetse used also to be present at certain shady spots on the water-courses tributary to the Shangani from the south, but the writer could find none after 1920 between Walker's Road and Sebasinungu, although Mr. Chorley (Assistant Entomologist) in June, 1921, saw a few fly on Walker's Road near the Madwala, and fly were occasionally reported elsewhere in this area up to May, 1921. By 1921 also the greater part of the Kana River within the area of operations was nearly free from fly, although formerly very heavily infested. This condition was also maintained in 1922. A few fly were seen in October, 1922, close to the Palm pan, but the presence of a camp at the pan may have been a contributory cause, the fly being carried in by the hunters from the Mzola and further up the Kana. North of the Mzola and Shangani "fly" persisted in some numbers at the end of the operations, especially up the Mzola. Great reduction was, however, recorded on the lower Mzola and north of the Shangani. Up to 1921 Ngondo salt pan was largely outside the limits of effective shooting, and much game had congregated in that

region. In 1920 the fly was more numerous in this locality than had been observed before, so much so that the writer and a companion were glad to beat a retreat. As it was not intended to include this spot in the operations, no actual count was made, but the impression gained was that the number caught in a given time would depend mainly upon the speed with which the flies could be caught and bottled. At this time also fly occurred in some numbers along the edge of the "gusu" between the salt pan and Sebasinungu's kraal. In October, 1920, a European hunter was stationed at Ngondo, and in April, 1921, the officer-in-charge, weary of vainly seeking game near No. 2 Main Camp, transferred to Ngondo, and a great number of buck were shot in this region and up the Mhlegwa River. The Ngondo camp was vacated again in June of the same year on the writer's instructions, but the hunters stationed at "F Post" were ordered to pay as much attention as possible to the neighbourhood of the pan. In October, 1922, no fly were seen at or in the vicinity of Ngondo salt pan, although the writer camped there for two nights. The natives at Sebasinungu's kraal also affirmed strongly that the fly had altogether disappeared.

It will be seen, therefore, that the fly disappeared or was reduced to a minimum comparatively rapidly in the readily accessible portions of the area where the forest is open, but that in the neighbourhood of "isinanga" and broken country, and in less accessible parts generally, the reduction was not so complete, although at all points of observation it was none the less very great. The north-eastern part of the area, of course, is adjacent to heavily infested fly country, and this may also have contributed to the persistence of the fly in these parts.

Owing to the great influx of game in 1922 it is obvious that for the purposes of the experiment the previous year's observations were the more important. It had been hoped during the concluding year to reap the cumulative benefit of the work of the three previous years, but this was counteracted by the influence of the drought, and possibly the other factors mentioned, in causing an unusual concentration of game. It will be observed that 1922 showed little material difference in the prevalence of fly compared with the previous year except at Ngondo salt pan. It has been suggested that the drought of the preceding summer might have had an adverse effect, and this point must not be overlooked, although evidence collected during the past thirteen years shows conclusively that drought has no very marked adverse effect on *morsitans* in general, and experience during 1922 in different parts of the Territory was very far from indicating a general check to the pest. The writer is, in point of fact, inclined to regard drought as favouring the fly. In any case it is hoped to make further observations in the area of the experiment during the present year, and to pay special attention to the neighbourhood of Ngondo, whence the pest certainly appeared to disappear rather abruptly.

It need hardly be said that the same considerations which led the writer to utilise the unpleasant month of October for purposes of comparison also induced the avoidance of comparative observations on days when weather conditions might have been unfavourable to activity

on the part of the fly. Lengthy experience with this particular species of tsetse had supplied abundant data in this respect. In reality, however, the weather conditions experienced during the October inspections were remarkably uniform. The near approach of the rains was evident on each occasion by the intense heat and thundery atmosphere, and very local thunderstorms, consisting more of electric discharge than rain, sometimes occurred in the late afternoon or at night. The mornings, however, were almost uniformly bright and sunny, and this part of the day was mainly utilised for observations, camp being left shortly after daybreak for the different points, so as to get through the work before the heat of the day became too oppressive. Under these conditions the fly becomes extremely active during the earlier part of the morning, as experience at the more heavily infested centres showed. The writer kept a daily bulletin of the weather in his diaries, and the readings are monotonously similar. An unusually early wet season would undoubtedly have somewhat interfered with the October inspections, as it would have been necessary to wait for the effect of any heavy showers to be dissipated before observations were made, and sufficient rain to have brought the *mopane* into general leaf would have been disastrous. This, however, did not occur, although on two occasions the weather broke seriously during the return journey to the railway.

It should be noted also that the information given by the writer's observations was always tested by questioning the hunter whose area included the points of observations. The hunters were instructed to note and report concerning the prevalence of fly in their wanderings, and took great interest in the matter.

It was a very rare occurrence for any material discrepancy to occur in information tendered by the hunters. On the one or two occasions when this occurred the writer not only re-visited the locality in question, but the officer-in-charge paid several subsequent visits and submitted a report.

It has already been stated that the area was inspected at other times of the year than October. Visits were made in May, July and October, 1919; August and October, 1920; May, June and October, 1921; June, July and October, 1922. During the rains and in the winter months from May to August the fly in the area is, however, not limited in its range by lack of general shade as it is in September and October, and its occurrence at any particular spot may be largely fortuitous. Under such conditions suitable comparisons are very difficult, and it is obvious that the safest method is to judge of the comparative abundance of the pest during the season of intense concentration. As illustrating this point, it may be stated that no fly could be found at the Mzola index 1 in August, 1920, or in July, 1922, although specimens were afterwards taken there in October of each of these years.

Apart from its general distribution, the fly was apparently extremely scarce almost everywhere in the area during the colder months

in the last two years of the experiment. During ten days in May and June, 1921, the writer in company with Mr. J. K. Chorley traversed much of the country utilised in the October inspections, and, catching every fly they could, made a total of 24 (21 males and 3 females); of these, 11 (10 males and 1 female) were taken at Ngondo salt pan, where the game had not been effectively dealt with the previous two seasons, and 7 (6 males and 1 female) were taken on a traverse through Bira and Lubimbi, four males being added when crossing the Shangani on completion of this round; and these were probably carried. The areas visited during this trip included the path to the main camp, the Bira River and Lubimbi, the south bank of the Shangani from two miles below the main camp to Ngondo salt vle, the Mzola from the crossing near the two indices to beyond the area, the Kana index (Palm pan), the Kana River in that neighbourhood and the Mhlegwa River. Several flies apparently followed the party across from the Mzola River at the salt vle or pan outside the shooting area to the Kana. They were not molested *en route*, as it was desired to watch them, although, of course, they were not marked. One female was taken in an hour's search at and round the pan from 4 to 5 p.m., the weather being still and warm. Odd fly were seen along the north bank of the Shangani between the Mhlegwa ford and Ngondo camp, and are not included in the captures, as this region had been beyond the limit of effective operations. Mr. Chorley, who remained in this region after the writer left and carried out an inspection of some other localities, largely outside the area, took one fly at the Gwaai-Shangani junction after moving down from the Bushu post, and seven on Walker's Road, just north of the Madwala. In the latter connection it must be noted that the Madwala is on the footpath constituting a highway to Chief Pashu's area in the north, and is much used. From Lubimbi northwards it is infested with fly practically all the way, and the Madwala is a halting place. This region was visited twice the following October, and once in June, and again in July, 1922, with negative results.

In June and July, 1922, fly was extraordinarily scarce in the area, and as this trip was extended into a visit to the Zambesi northward through fly country, it served somewhat as a control in respect to any possible effect of the previous season's drought, and so may be worth recording. The area was entered on 18th June, and the first five days were devoted to examining the country between the Sikume and Shangani junctions with the Gwaai River, including the Madwala, Bushu salt pan, etc. No tsetse were seen anywhere. A move was then made across to the main camp by the main footpath. No fly were seen anywhere *en route*. Similarly, none had been seen at the main camp, which had only been occupied for a few days. Lubimbi was visited from the main camp through the Bira River, returning *via* Msolozzi and the south bank of the Shangani. No fly were seen at all. The Mzola indices were also visited, and no fly were seen at either. On the same day the party, consisting of three white men and six natives, walked steadily northwards for two-and-a-quarter hours. One fly, a female, was taken about two miles north of the Mzola index 1, and another was seen at the furthest point, where a considerable rest occurred. The return was made directly to camp,

which was reached at 4 p.m., one further fly being seen not far from the Shangani. Game seen during the walk included about six impala in one herd, one duiker and one Gray's steinbok. The Kana River near Bondo hill was also visited, the party following the Shangani upwards and crossing just below the Mzola junction. The Mzola was then crossed, and the Shangani followed along to near the Kana, which river was then followed at some distance until nearing the camp. Here one tsetse fly was seen, and immediately afterwards a herd of koodoo was surprised at close quarters near the thick isinanga. Later the party returned directly across the "isidaga" to the Mzola, near which river a rietbok was shot, and the river was followed down past the Mzola index spots back to camp. Only the one fly was seen during the whole day.

The journey north to the Zambesi was made *via* the south bank of the Shangani and Msolozzi, thence across the river by the footpath leading northwards past Lubimbi. This path passes the portion of the vlei where tsetse had usually been met with most freely, but no fly were seen. Tsetse was first encountered at the Sibone crossing, and thence for a number of days was always in evidence. Along the Nagapande (not shown in the map) fly was present in moderate numbers, game being obviously present, and further north on the Lubu River, where game was really concentrated, the flies were present in great numbers, both on the upward and downward journey. The leader was greeted by a sudden rush of the flies, which accompanied the party in great apparent excitement whilst still moving, but quieted down during the halt on both occasions. On the return journey the flies woke up again as soon as the party started, and buzzed round like a swarm of bees, several individuals following for six to seven miles. The return journey revealed fly throughout the same strip of country as far as the Sibone. From here the path taken diverged towards Bira post (deserted), and owing to a confusion as to direction, some delay occurred at the Bira River, which was first followed down for a few hundred yards and then up. After crossing, the path led through the fly haunts to the old camp, and a halt of nearly an hour was made. No fly were seen at all until after some time at the halt, when a male was taken. No fly were seen during the walk thence to the main camp, but after arrival a male was taken inside the camp. This may have come from anywhere. A further excursion up the Shangani to Ngondo, a distance of 18 miles, revealed no fly either going or coming, but one was seen at Ngondo, where the party camped for two nights. On the upward journey the weather was overcast and chilly, and so not very favourable for fly activity, but at the "pan" and on the downward journey it was sunny and warm. During the stay at Ngondo the Shangani was crossed, and a visit paid to a spot some distance up the Mhlegwa. Fly was present on the north side towards the Mhlegwa junction, some half dozen or so being seen. This region is, of course, beyond the limits of the shooting area.

The party then returned down the Shangani by the south bank to Walker's Road, passing Mzola and then pushing through the rough country close to the Shangani, through which there is no footpath.

Walker's Road was reached within a mile of the Shangani, and then followed to the Madwala. No fly was seen anywhere.

It will be seen then that during the whole of this journey the number of fly seen within the area, including Ngondo, consisted of seven. On 10th August, 1920, a single visit to the Bira River produced 19 flies (12 males and 7 females), whilst another walk next day to the Mzola index and round west and south to the main camp (No. 2) produced 9 (5 males and 4 females).

The foregoing details have been given with a view to demonstrating that had the results of the experiment been judged on the basis of inspections made during the winter months, they would have been even more striking than is actually the case. These observations, of course, help to confirm the results of the ensuing October inspections. It is likely that some increase of fly took place between July and October, 1922, quite apart from concentration, owing to the great influx of game into the area which commenced in August. That the fly can occur in great numbers even during the winter months is, of course, well known, and has been experienced on numerous occasions by the writer both within the area of the experiment and outside, quite apart from his experience on the Lubu River in July, 1922. In the reports of the officers-in-charge during 1919 and 1920, nothing figures more prominently than the abundance of fly at Lubimbi and the Bira River in all the months during which the operations were in progress, and this included nearly the whole of 1920. Abundance of fly on the Kana in August, 1919, also led to the establishment of the Upper Kana Post. These localities may, therefore, be regarded as both wet and dry season haunts.

On the other hand, fly was never found actually at the Mzola indices until about September, not only in the writer's own experience, but also in that of successive officers-in-charge. Fly were, however, encountered in the vicinity during the period when the mopane is in leaf, and presumably became concentrated into these shadier areas in the late dry season.

With respect to the following details of observations made on the prevalence of fly in October each year, it is to be emphasised that no claim is made that they constitute *closely accurate* estimates of density.

A very extensive series of observations would need to have been made had any such purpose been in view. The making of such observations would have necessitated the continuous residence of an entomologist in the area, a proceeding which was not only impracticable, but would have served no useful purpose, in that against the laboriously acquired estimates of density of the fly could have been placed no figures of any exactitude, or anything approaching exactitude in regard to the density of game at the various points of observation. It is obvious that only very broad effects could be dealt with in an experiment of this nature. More exact work might one day be carried out when one of the African Governments undertakes the experiment already referred to, in regard to total exclusion of "big game" from a fly area by an adequate fence.



The figures given were collected as a check to the writer's general observations and those of the resident hunters. Their significance lies in their general consistency, both with each other and with the more general observations, and in the wide divergence between the earlier and later totals.

(1) *Bushu Salt Pan and Country South of Shangani from Gwaai-Shangani Junction to Sibone Confluence.*—

1919-1921. Fly always met with in small numbers here and there in traversing this tract, and at least a single fly seen at the salt pan, though sometimes four or five were taken; noticeable decrease in October, 1921; Mr. Chorley encountered a few fly, catching seven, on Walker's road near Madwala on the northern side in June, 1921.

1922. No fly seen at Salt pan or elsewhere in vicinity in July or October; nor near the Madwala in July; but a single female taken in October on Gwaai about a mile above the junction after travelling down the Shangani from Bushu post.\*

(2) *Sibone River† to Msolozzi along North Bank of Shangani.*—

1919-1921. Fly always encountered in twos and threes. Marked diminution in 1921.

1922. Only one fly seen in October.

(3) *Msolozzi to Main Camp No. 2 along South Bank of Shangani.*—

October, 1918-1919. Fly present in small numbers throughout, especially close to Msolozzi and in strip of river forest extending about a mile and a half below the main camp.

October, 1920-1921. No fly present anywhere along this tract.§

(4) *Main Camp No. 2 to Main Camp No. 1 along South Bank of Shangani.*—

October, 1919. On the edges of a series of vleis near the river fly was to be met with in small numbers, and in greater numbers in a strip of river forest close to main camp No. 1.

\*No fly were seen by reliable witnesses at Bushu salt pan during the six months of the operations in 1922, but odd specimens were seen in the vicinity.

†The Sibone River for a mile or so above its confluence was a distinct fly centre up to the beginning of 1921; 19 males and 13 females were reported to have been casually caught by hunters in two days in this region in September, 1920. This locality was carefully examined by the writer in October, 1921, and no tsetse was seen away from the river, and only odd specimens there.

§Fly were freely carried to No. 2 main camp in 1920 from the heavily infested Bira region and from the Mzola on the north side of the river, but they usually disappeared next day. In September, 1920, the officer-in-charge was attacked by a small swarm at daybreak close to camp and secured 2 males and 11 females. The writer, however, never saw fly near the camp in spite of diligent search, except after returning from the fly haunts mentioned above.

October, 1920. Fly apparently disappeared from strip of forest near main camp No. 1, and only odd specimens seen elsewhere.

October, 1921. A careful search along the series of vleis produced only three flies, and none was seen elsewhere.

October, 1922. Only saw one fly along this series of vleis in a search occupying several hours; this was taken immediately opposite the Mzola River; none was seen at any other point along this tract.

(5) *Main Camp No. 1 to Ngondo Salt Pan along South Bank of Shangani.*—

October, 1919. Odd fly encountered *en route* and numerous at salt pan; also along edge of "gusu" to Sebasinungu.

October, 1920. Fly numerous at Ngondo and very aggressive; odd fly still to be met with between Ngondo and No. 1 main camp.

October, 1921. Not visited in October, but in June took 10 males and 1 female in about  $1\frac{1}{2}$  hours around salt pan; odd flies also seen in vicinity, but forest towards "F post" apparently clear.

October, 1922. No fly seen at Ngondo nor in vicinity nor along path to Sebasinungu, nor between Ngondo and No. 1 main camp.

(Note.—One fly was seen at Ngondo during a day in July, 1922. In his September report the officer-in-charge stated that there appeared to be no fly at this centre. In October the hunter stationed at "F post" reported similarly, and after the writer's inspection the natives at Sebasinungu stated that fly had disappeared from the vicinity. The natives had a few goats and a dog, and stated that no losses had occurred during the past year. The pan, which at the time of the writer's visit in 1919 showed fresh spoor of almost every species of local antelope, only showed spoor of an odd roan and sable in 1922, and these were probably nocturnal visitors.)

(6) *Lubimbi Salt Vlei.*—

This vlei is of considerable extent, perhaps a mile and a half long and three-quarters of a mile broad. It is flanked on two sides by thick "isinanga," but the forest is more open to the north and between the vlei and the dense environs of the Bira River. The vlei itself contains dense beds of reeds, which remain green and do not burn. The path to Pashu's area in the north leads through it, and this path is much used, parties coming down to collect salt at the vlei itself or passing it on the way to and from the Gwaai River past the Madwala. In point of fact this constitutes practically the only footpath to the north out of the area, although another runs through Stimela's kraal on the lower Sibone from Sianyanga's across the Gwaai River. The vlei was inspected with reference to tsetse fly by walking round it, paying particular attention to the shady spots.

The time spent at the vlei was approximately the same on each occasion, consisting of about two hours. In 1922 a rather longer stay was, however, made.

October, 1919, caught 22 males and 2 females.

October, 1920, caught 18 males and 10 females.

October, 1921, caught 12 males and 3 females.

October, 1922, caught 3 males and no females.

It is obvious that the above figures up to 1921 do not indicate any very material reduction, and owing to failure to catch more than the three males indicated in October, 1922, Mr. Kemp, officer-in-charge, was requested to keep a special watch on this centre and report later. On 2nd November he visited the vlei and failed to find any fly at all. From 31st October light showers had fallen in the area, and on 5th November heavy rains fell all over, being estimated at approximately 1 inch at the main camp. On 7th November Mr. Kemp again visited Lubimbi and caught 24 fly, 20 of which (15 males and 5 females) he forwarded to the writer at Salisbury.

Lubimbi was a difficult place to control in respect to game on account of the dense country adjoining it and the lack of drinkable water at the vlei itself. It lay within the area hunted from the Msolozzi post, a nearer camp being impossible, after the Bira water was gone, on account of the dense thicket between the vlei and the Shangani. The dense reeds in the vlei afforded good cover for bushbuck and reedbuck, which were not eliminated to the last. It has already been remarked that Lubimbi is at least as much a wet season haunt of fly as a dry, and the appearance of a number of fly at this spot after heavy general rains have fallen is not surprising, seeing that it adjoins the solid fly belt to the north through which a frequented footpath runs. The apparent tendency of fly to follow far in dull weather is commented on later, and the passage of a herd of game, a troop of baboons or a party of natives might readily account for a sudden appearance of tsetse in such a spot. None the less, had all the centres kept under observation given no more definite results than Lubimbi, it is obvious that the result of the experiment as regards the effect of shooting on the fly must have been regarded as inconclusive.

(7) *Between Main Camp and Bira Post, and at Bira River.*--

Fly was exceedingly abundant round the Bira post and at the Bira River during the first year of the operations. The post could only be occupied during the earlier part of the dry season, as the water was not permanent, but after paths had been formed the region was much hunted from the main camp No. 2. Several rhino were killed in this region in 1919 and 1920. In 1920 fly was still plentiful, but a great reduction was manifest in 1921.

October, 1919. Fly present in great numbers.

October, 1920. 15 males and 15 females caught.

(N.B.—Two days previous to the writer's visit a party secured 17 males and 17 females at the Bira River without a net.)

October, 1921. 4 males and 2 females.

October, 1922. 2 males and no females.

(8) *Mzola Index No. 1.*—

This consists of a dry water-course running into the Mzola about  $1\frac{1}{2}$  miles above the confluence. It is an attractive grazing ground, and the country is somewhat park-like, although there is a certain amount of low growth. In examining this spot the method adopted was to collect all the fly seen in a given time and divide by the number of hours and the number of collectors. Usually two collectors worked for an hour on two separate days with several days' interval. The density is then reckoned on the number of males, the female percentage being also stated. This gives the following results:—

|                      | Male<br>Density. | Female<br>Percentage. |
|----------------------|------------------|-----------------------|
| October, 1918 ... .. | 20               | 16.6                  |
| October, 1919 ... .. | 14               | 44                    |
| October, 1920 ... .. | 5.5              | 50                    |
| October, 1921 ... .. | .75              | 77.5                  |
| October, 1922 ... .. | 3.25             | 23.5                  |

This is one of the only two spots where an increase was recorded in 1922 over the previous year. The steady rise in the female percentage up to 1921 is noteworthy.

(9) *Mzola Index No. 2.*—

This fly centre was only noted in 1920, when it was found to be frequented by both waterbuck and impala, and to be swarming with tsetse fly. The buck were promptly dealt with and the spot regularly hunted afterwards. In the following table the figures are not strictly comparable, for the reason that all the visits were not timed, and in 1922 the catch (b) was made over a much longer period of time and over a much more extended area than at previous visits. The reduction in the number of fly was very marked in 1921 and 1922.

October, 1920 (a) 38 males: 30 females caught by party on short visit (of these 18 males and 22 females were caught at one spot in half an hour with two nets by two of the party, including the writer).

October, 1920 (b) 22 males: 15 females (30 minutes with two nets at one spot).

*Note.*—A further 8 males and 5 females were taken casually close by as party was leaving the spot used for collecting.

October, 1921 (a) 2 males: 2 females (half an hour with two nets; the smoke from a neighbouring grass fire may have influenced this catch).

October, 1921 (b) 10 males: 6 females (not timed, but over an hour, two nets).

October, 1922 (a) 7 males: 4 females (about one hour, two nets).

October, 1922 (b) 6 males: 2 females (most of morning, with two nets; much larger area than usual covered, the whole vicinity being covered, and the south bank of the Mzola down to its junction with the Shangani).

[*Note*.---The Mzola indices, as has already been stated, constitute essentially late dry season foci for fly. According to reports, fly diminished very rapidly at these centres after general rain had fallen and the mopane had flushed into leaf. Being near the main camp (No. 2), a continuous watch was kept on these spots by the officers-in-charge, and the results of the writer's inspections were very fully confirmed. In the same letter reporting an increase of fly at Lubimbi after general heavy rains had fallen in November, 1922, Mr. Kemp stated that very few fly could be found at Mzola index No. 1, and none at all at No. 2. A similar effect was reported by Mr. de Buys after heavy rain in 1920.]

(10) *Kana River: Palm Pan*.—

This is a small "pan" which the writer had noted as heavily infested with fly in September, 1916. As an index, however, it had a drawback owing to the presence in the pan of a hunting post and consequent following in of fly from elsewhere. The post was occupied from August, 1919, and in 1920, but had been vacated for some months previous to the writer's visits in 1921. It was again occupied in 1922

October, 1919. 41 males and 17 females collected in about 2½ hours with one net, after which no more flies could be found; below pan on banks of river 8 males and 10 females caught in about half an hour; weather close, overcast and thundery, a few drops of rain at 12.30 p.m., and again at 4 p.m., not sufficient to wet soil.

October, 1920. 19 males: 15 females collected in about 1½ hours with one net, after which no more flies could be found; weather bright and sunny.

October, 1921. No males: no females. Remained at pan and on bank of river below all day from 9 a.m. One fly seen on bank of river—not secured; weather still, close, thundery, overcast forenoon, clearing later; no rain at pan.

October, 1922. No flies seen on arrival at pan, but 2 females caught on natives returning from river; in half an hour on river banks caught 2 males and 4 females with one net; weather bright and sunny. Subsequent visits by the officer-in-charge in 1922 revealed a very few fly at this centre; on the last visit only one was seen.

This spot received more prolonged attention than some of the other indices, as it was possible to camp for the night close by the pan, and the locality was, therefore, examined during the greater part of one day and the early morning of the next. The catch in 1919 occupied about 2½ hours in collecting (1½ hours a.m. and 1 p.m.), but was prolonged for a considerable time afterwards without any addition being made.

In 1920 the locality was examined for about the same length of time, but all the flies appeared exhausted in 1½ hours. In 1921 the whole day from shortly after 9 o'clock was spent at the pan. The vacation of the post some months previously must be considered in connection with these comparative observations, but fly was certainly abundant here before the post was established. In September, 1916, the locality swarmed with tsetse, and the presence of the fly in abundance in August, 1919, led to the establishment of the post. A number of rhino were killed in this vicinity that year. Fly would undoubtedly follow parties to this spot from the heavily infested pan up the Mzola River (beyond the limits of the area), which is only a very easy two hours' walk away, and from the intermediate area where game remained prevalent throughout. In May, 1921, several flies apparently followed the writer's party across in this way. It is noteworthy that except towards the river this pan is surrounded by "gusu" forest, and that no flies could be caught on any visit away from the pan in this class of forest.

(11) *Kana River.*—

For several miles below the Palm pan the banks of the Kana swarmed with fly in 1916. The writer failed to reach the spot in 1918, but in 1919 tsetse was abundant along this stretch, and was remarked upon in August by the officer-in-charge of the operations. Close to the Bondo camp fly was also prevalent, and in 1920 15 males and 8 females were caught casually when crossing the river at this point on the upward and downward journey. In 1921 and 1922 none at all was seen anywhere near the crossing, although in the latter year the party halted for breakfast and spent several hours in the shady fly haunts on two separate days. The enormous decrease of tsetse fly all along the Kana within the area was, moreover, borne out by the hunters stationed there. In point of fact but for the following of fly from the Mzola, and from further up the Kana, the section of that river within the area was almost, but not quite, free from tsetse by 1921.

(12) *General.*—

As a general indication of the reduction of fly throughout the area, the totals collected by the writer's party in October at the various spots used as indices during the last three years of the operations are as follows:—

1920. 286 (155 males and 131 females). *Note.*—This excludes 17 males and 17 females collected on an independent visit to Bira by a portion of the party. Ngondo is excluded throughout.

1921. 54 (31 males and 23 females).

1922. 49 (33 males and 16 females).

The totals refer to the same number of visits to each index spot, but in 1921 and 1922 the visits on several occasions were more prolonged, and on account of the scarcity of fly, and, therefore, the less time occupied in capturing them, more ground was covered, so that the balance is well in favour of the reduction being greater than that

indicated. In 1919 Bira was not intended as an index, as it was clear that the camp would have to be vacated, and on this account no count was made. Mr. de Buys, afterwards officer-in-charge, was stationed at this spot, and apart from the writer's observations was very emphatic concerning the abundance of tsetse during his sojourn there. The difference in prevalence of fly between 1919 and 1920, as reported by the writer in the latter year, was too small to be of any account as regards judging the effect of the shooting up to that time.

Although the comparison is not so just as the totals collected at the indices, it may be mentioned that in October the average catch per day on which any flies were taken by the writer (excluding Ngondo) was 50.3 (27.8 males and 22.5 females) in 1920, 6.7 (3.5 males and 3.2 females) in 1921, and 6.8 (4.6 males and 2.2 females) in 1922.

The apparent effect of the operations on the *limits* of the fly-infested area calls for some mention. It will readily be understood that the geography of the area, which is, of course, unsurveyed, was much less accurately known before the operations commenced than it was later. The hunters explored gradually in all directions, and paths were formed which served as a guide, so that what was once almost *terra incognita* became familiar ground. Although the writer had travelled up the Shangani River from its junction with the Gwaai in 1918, the Bushu salt pan was not discovered until 1919, and was then reported as being below the Madwala, its proximity to the Gwaai being unrecognised at the time owing to the hilly nature of the country. At first the Gwaai River was in fact thought to be much further from the Madwala than proved to be the case, the direct route between the two being shut off by a dense "isinanga" and broken country. Consequently it might be expected that tsetse would be located beyond the previously recognised limits, as the area was patrolled in all directions, but this did not prove to be the case. It is true that reports were received from irresponsible parties to the effect that fly was present in numbers at various points on the Gwaai River, and this was the cause of repeated inspections of this region both by the officer-in-charge and the writer or one of his staff; these inspections invariably gave negative results. The writer in July, 1922, offered a reward for the first tsetse fly caught on the Gwaai side of the watershed by any of the natives accompanying him, and again renewed the offer the next October, without result. It may, in fact, definitely be stated that no advance of the pest took place during the four years of the experiment, although the previous four years had witnessed an advance of 10 to 12 miles towards the Gwaai River.

None the less it is certain that tsetse fly were, under favourable circumstances, sometimes carried across to the Gwaai River. In May, 1919, a fly was seen by the writer close to the Gwaai when the party had followed Walker's Road from the Madwala to the river, but subsequent efforts to find fly at this spot uniformly failed. In July, 1921, however, a male and female were taken close to the drift by hunters who had hunted the vicinity for ten days, but they failed to find any afterwards. These specimens had probably been carried from the

Madwala region. Again in October, 1920, the party left No. 2 main camp for the railway on a dull morning which quickly developed into rain. At the breakfast halt at Mazwa (see map) a *female* tsetse was caught on the writer's neck. Further, in July and August, 1921, several fly were reported to have been caught on the main footpath between Mazwa and the Gwaai, having apparently been carried over by the native carriers who passed regularly backwards and forwards bringing supplies from the railway. The reliability of some of the reports in this connection is doubtful, but there appears no doubt that several flies were caught, and one of the hunters, who had been instructed concerning the sexual characters, stated that he took a male and a female, and that on several occasions fly had followed him from the main camp No. 2 to Mazwa. Game had rather congregated on the Gwaai side previous to that time on account of persecution near the Shangani, and instructions had been given to deal vigorously with it, as spread of the fly was feared. This was promptly attended to, and the game, mostly waterbuck and pig, soon disappeared. No fly has been located there since, nor seen at any time away from the footpath. The distance from No. 2 main camp to where the fly were taken is 16 miles, and no tsetse have been definitely located in between since the path was opened in 1920. It would appear that the flies only follow to this extent in cool or cloudy weather, and the observations have, of course, considerable bearing on the question of the origin of the outbreaks of fly disease amongst cattle on the Gwaai River.

**Effect on Relationship of Tsetse Fly to Man.**—It has been suggested by several investigators in the past that game destruction might result in *G. morsitans* tending to concentrate on human beings, and thus increase the danger of epidemics of sleeping sickness. Mr. C. F. M. Swynnerton in a recent paper asserts that this has actually happened in the case of a distinct, but closely related species of tsetse fly, in Tanganyika territory. The area of the experiment under consideration is, as already pointed out, practically uninhabited, but a considerable temporary population was present in the persons of the staff employed during the four years of the experiment. It should be mentioned that several of the native hunters had their wives and children with them, and that a great amount of visiting on the part of natives, particularly women, from regions outside the area took place, so that the main paths were frequented to a considerable extent. The path communicating between the railway and the main camp was traversed regularly by parties of carriers bringing in supplies and carrying hides to the line. Tsetse flies undoubtedly followed the hunters continually to their camps, and the main camp, on account of the greater amount of traffic, was particularly affected in this respect, and also the upper Kana post on account of its proximity to heavily infested country. None the less the flies carried to the main camp at least certainly did not remain in that vicinity, nor did fly concentrate on the line of communication with the railway. In point of fact, the fly disappeared most rapidly in the vicinity of the camps, although these were practically all situated in favourable country for the insect. The fly also disappeared, apparently entirely, from the previously



infested neighbourhood of Sebasinungu's kraal. Briefly, there was not the slightest indication of a tendency to concentrate on man, and during the latter part of the operations, as emphasised in the reports of the officers-in-charge, the untenanted spots where tsetse at the commencement was most abundant, still maintained their character in this respect in spite of the general reduction of the pest, and the area south of the Shangani, which was the portion of the area most traversed by human beings, became practically free from the fly. Any tendency to concentrate on man must have been in evidence around the main camp, on which most of the paths converged, but no such concentration occurred.

**Observations as Controls to the Experiment.**—Contemporaneously with the decrease of tsetse within the experimental area, the advance, which has been recorded in respect to the Sebungwe fly area since the rinderpest (1896), continued elsewhere. Between 1920 and 1921 a further ten miles\* at least of the Shangani River, immediately beyond the limits of the operations, became infested with fly, whilst to the north advance as far as a point on the Madaba River, where there was a kraal belonging to a native named Mbopo, also occurred. The actual distance advanced in the north during the four years is not known, but the writer confirmed the presence of fly at Mbopo in July, 1922, and a long strip of country formerly free was found to have become infested. Elsewhere in the Territory the encroachment of tsetse during the past few years has been causing considerable anxiety, and has synchronised with great increase of game in the region of the Umniati River, although a few years ago, when the game was vigorously hunted in these regions, the fly was apparently stationary.

**Deductions.**—There would appear to be little room for reasonable doubt that the reduction of fly within the experimental area is the result of hunting and destroying the larger mammals. It is, of course, desirable in scientific research that experiments should be repeated several times before definite deductions are drawn, but the repetition of experiments costing several thousands of pounds apiece is not practicable. It must be borne in mind that this experiment was regarded from the first as the culminating test in connection with a considerable mass of evidence all tending to show that *Glossina morsitans*, at least in the regions south of the Zambesi, cannot generally persist in the absence of the larger mammals. The observations recorded here are altogether confirmatory of the assertion of the early hunters and explorers, that where the game is ruthlessly hunted the fly tends gradually to disappear.

No claim is made that the destruction of game by paid hunters constitutes a widely applicable method of getting rid of the tsetse fly.

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\*The limits of the fly up the Shangani in 1920 were noted by several observers on different journeys, including the officer-in-charge and the writer in August, and the Forest Officer and the writer in October.

The animals destroyed, in point of fact, cost the Government something more than £1 apiece. Nor is it claimed that the destruction of game is desirable or even calculated to get rid of *morsitans* and its allies in all parts of Africa. It has recently been asserted that in country which carries a considerable native population tsetse fly can subsist on the natives themselves, and destruction of the game is, therefore, calculated to increase the danger of sleeping sickness epidemics. However this may be, the point is not of practical significance in connection with the depopulated fly areas of this Territory.

The experiment was carried out with a view to ascertaining the effect of game elimination on the tsetse fly, and of gaining information concerning the cost and duration of operations of this nature if undertaken by the Government. The result is apparently that under the conditions prevailing in the area game elimination is followed by elimination of the tsetse, but the cost of the experiment is sufficient to show the economic impracticability of operations along similar lines over large areas of country. It may be pointed out, however, that the actual cost *per acre* in the area involved was only about 4½d., and although this expenditure has not resulted in altogether ridding the whole area of tsetse fly, the apparent effect of the shooting on the tsetse in the more open and accessible parts indicates that in particularly favourable country, or in country of more intrinsic value, organised game hunting might prove economic. This is more likely to be the case in respect to small fly belts, which could be treated as a whole, and the recovery of the market in respect to hides and biltong would undoubtedly considerably mitigate the expense. The area utilised for the experiment was undoubtedly one in which the elimination of game was more than usually difficult on account of its adjacency to heavily stocked game country and its particular attractiveness to game animals, which led to constant immigration. On the other hand, other parts of the fly areas in this Territory would in many cases be more difficult to hunt effectively on account of remoteness from the railway and less evenly distributed water supply. In general, as far as Southern Rhodesia is concerned, it would appear that the application of the knowledge gained would need to take some other form than organised shooting by paid hunters.

**A Possible Criticism Anticipated.**—It may be contended, by those who are of opinion that grass fires are inimical to the tsetse, that the intensive burning accompanying shooting operations may have been the cause of the reduction of the pest in the area. It therefore appears advisable to point out that, apart from other considerations which, in the writer's opinion, negative the idea that grass fires have any general adverse effect on the fly, the manner in which the grass was burnt each year during the experiment was that calculated to have least effect in this connection. The grass was, in fact, burnt as soon as it would take fire, the result being exceedingly patchy work and absence of widespread conflagrations. In any case the grass can only be burnt once a year, and the area involved has been regularly burnt by the natives, although not so early nor in such detail as during the operations.

**SUMMARY.**

(1) An experiment to determine the effect on the tsetse fly of vigorously hunting "big game" in an area approximately 500 square miles in extent was carried out during four successive dry seasons and including the greater part of two wet seasons.

(2) A staff consisting for the greater part of the time of four Europeans and about fifteen native hunters was employed, the hunters being scattered at selected posts throughout the area and instructed to hunt the vicinity of their posts. Fifty native porters were also employed.

(3) Nearly five thousand head of game were actually "bagged" during the operations, but total elimination of the game was neither effected nor approached owing to immigration from outside, especially marked during the concluding year, when the country generally was held in the grip of an unprecedented drought.

(4) The monthly returns of game killed are far from constituting a correct index of the density of the game within the area for reasons given.

(5) The operations resulted in approximate banishment of big game during the day time from the haunts of the tsetse fly.

(6) The tsetse fly diminished greatly throughout the area during the experiment, and apparently disappeared from a considerable portion formerly infested.

(7) The tsetse fly disappeared from or diminished most readily in the more open and accessible portions of the area, proving more persistent in and near broken or thick country or that which, on account of lack of permanent water, was less intensively hunted.

(8) The extension of the fly-infested area, which had been proceeding steadily for 23 years up to the commencement of the experiment, apparently ceased entirely in the area from the first year of the operations.

(9) The extension of the fly-infested area continued during the experiment on either side beyond the limits of the area.

(10) The general tendency of the fly areas throughout the Territory during the experiments has been progressive, advances, sometimes associated with the death of native cattle in formerly healthy areas, having been recorded in many parts.

(11) It is not possible to dissociate the reduction of fly in the experimental area from the effect of the shooting operations, and the results obtained indicate clearly that the tsetse fly (*G. morsitans*) in this area is dependent upon the larger mammals for its food supply, and it is reasonable to deduce that this is also the case elsewhere in the Territory, although exceptions may possibly occur in certain localities.

(12) The net cost of the operations, although high in the aggregate, amounted only to about 4½d. per acre, and although this expenditure did not result in the whole area being freed from tsetse fly, the results

obtained in the more open and accessible portions suggest that *in particularly favourable localities or where the land is of greater intrinsic value* the elimination of tsetse fly by organised game hunting on the part of paid hunters might not prove uneconomic.

(13) Over large areas of indifferent country it is judged, however, that the application of the knowledge gained would need to take some other form than operations of the nature adopted for the purposes of the experiment.

**Brief Review of Lessons Learnt from the Experiment.**—The apparent effect of the rinderpest epizootic in 1896 was the total disappearance of tsetse fly from large areas of country within a single wet season. At the commencement of the present experiment it was thought that a similar phenomenon might be brought about by a sudden and intense onslaught on the game within the limited area selected. This did not occur, however, and the difficulty of eliminating game within a limited well-watered area, adjacent to heavily stocked game country, is one of the important lessons learnt. The 1922 operations were undertaken with a view to reaping the accumulated benefit of the operations during the previous three seasons, but the unprecedented drought of the 1921-22 wet season caused also an unprecedented concentration of game, which must have afforded increased feeding facilities to the fly where still present; the accumulated benefit was, therefore, not forthcoming—in fact, conditions were more favourable to the fly as far as game is concerned than during the preceding year. As droughts must be anticipated at intervals, this constitutes another practical point to be taken into consideration in any scheme aiming at controlling the fly through the game.

The results of the experiment cannot, therefore, be said to encourage any undertaking in the way of wholesale elimination of game. It is obvious that over the usual class of country involved in this Territory such operations would be very expensive, prolonged and difficult, and the possibility of complete elimination of the fly by this means in thick, broken or ill-watered country is by no means established.

The most favourable features of the results consist firstly in the apparent disappearance of fly from a considerable area south of the Shangani, where the forest is open and accessible.

The establishment of a complete negative as regards tsetse fly is, of course, a very prolonged operation, and almost impossible within following distance of known fly country, so the word "apparent" can only be used. That reduction approaching to elimination occurred in these parts is, however, certain, as they were traversed regularly in all directions by the hunters, many of the paths passing through the former fly haunts. Secondly, the apparent check in the advance of the pest within the area, in conjunction with continued extension on either side, suggests that checking the advance of the fly is likely to prove an easier matter than eliminating it where established. Further experience is, of course, needed in this connection.

In general it may, therefore, be stated that the result of the experiment is negative as regards any hope of speedy and economic

elimination of tsetse fly by the employment of hunters to attack the game, at least in the class of country constituting the great bulk of the fly areas in the Territory, but that it affords strong evidence as to the vital importance of "big game" to the fly in general. Furthermore, the experiment bears out observations made elsewhere during the past thirteen years that under primitive conditions the fly only spreads in the presence of a considerable amount of big game leading a more or less undisturbed existence. In areas traversed by railways, motor roads, or even much frequented caravan routes, extension of the fly area may possibly occur under different conditions, with which the writer is unfamiliar.

It may be mentioned that the results of the experiment are not yet exhausted, and that a further detailed inspection of the area is projected during the present dry season.

**Supplementary Remarks.**—(1) *Baboons*.—Baboons are abundant in the area of the experiment along the rivers and near Lubimbi and Mbira. Although a few were shot, their numbers were not appreciably reduced, nor did they desert the area. On several occasions tsetse fly were encountered in the tracks of troops, but no *fed* flies were seen under these circumstances. The value of baboons as a food supply to the tsetse fly is not understood, some contending that the flies practically never succeed in feeding on account of the alertness of the animals, and others that baboons may be a favourite diet. The fact can only be recorded without comment. The presence of these animals in the area did not apparently affect the broad results of the experiment, but they may have helped to retard the reduction of fly in certain spots.

(2) *Following of Female Flies*.—The notes made as to the taking of female flies, apparently followers, on the footpaths on the Gwaai side of the watershed call for amplification, as the "following distance" of the females has been supposed not to exceed a few hundred yards. As this may lead some entomologists to infer that these flies must have actually bred out near the spots where they were taken, it is desirable to state that the writer convinced himself during the experiment that the females may and not uncommonly do follow parties as far as the males. Females were on several occasions actually watched on the back of a native across open country traversed by a path from the Mzola indices to main camp No. 2 and caught at the end of the journey of about two miles. On one occasion two flies were thus watched, and a single sweep of the net secured a male and female, showing that both sexes may rest quietly within a few inches of each other when being carried. At the main camp No. 2, whither flies were carried from the surrounding country, numerous observations showed a great predominance of females. This is not taken as suggesting that females were more commonly carried in than males, as collections of "followers" made *en route* to the camp showed a predominance of males, but that the females more persistently sought the shade of the huts and of the neighbouring shady forest of the river bank type, possibly awaiting suitable atmospheric conditions before returning to their usual haunts. This return, if it occurred at all, would presumably be made in the cool of the day. Certainly the "flies" did not remain in the vicinity

of the camp for any length of time, but it would appear that both males and females would attach themselves to parties leaving at day-break, as was the usual practice, even when by doing so they were carried in the opposite direction to their usual haunts. Probably they eventually tended to make their way back again, but this habit would account for the occasional observations of tsetse in unexpected places, where they are not usually to be found. It is to be noted that no tsetse fly were seen on the Gwaai side of the watershed away from the vicinity of the Shangani junction, except on the two frequented foot-paths.

(3) *Trypanosomiasis on the Gwaai River.*—It may be recorded that in 1922 the epizootic of trypanosomiasis amongst cattle on the Gwaai River did not exhibit its usual recrudescence; in fact it appears that no losses from this disease were recorded in this locality except at a kraal 25 to 30 miles above the Sikume. What relation this may have to the shooting operations is not known. The unprecedentedly dry season may have been the cause of the subsidence of the disease.

(4) *Wet Season Work.*—Owing to sickness amongst both Europeans and natives, it was found undesirable to continue the operations during the wet season, as the work tended to become disorganised and the hunters discouraged. Although not proved, it is thought that vigorous harassing of the game during the dry season when the fly is concentrated should suffice; the operations being continued until the advent of heavy rains results in the scattering of the game. Opinions expressed previous to the rinderpest on the relationship between "big game" and tsetse fly must have been mainly based upon the results of dry season operations.

(5) *Sleeping Sickness.*—The tsetse fly in this area were not supposed to be infective with a strain of trypanosomiasis pathogenic to human beings, but in 1919 an exceedingly distressing event occurred in the death of the young wife of one of the European hunters from sleeping sickness. This lady had only been a few weeks in the area, and had not wandered beyond the vicinity of the main camp (No. 1). This event was the reason for the premature closing down of the operations that year. No other case of the disease occurred throughout the four years of the experiment.

**Acknowledgments.**—The writer has great pleasure in bearing testimony to the services rendered by the European staff during the experiment, particularly the officers-in-charge, under conditions of considerable difficulty. It is particularly desired to mention Captain H. J. Brereton, B.S.A.P., Mr. A. J. P. de Buys and Corporals W. Pettit and A. H. Kemp, B.S.A.P., the successive officers-in-charge; whilst the Department is indebted to Mr C. Harveyson for assuming temporary control on the sudden retirement of Mr. de Buys in September, 1921. The co-operation of the British South Africa Police and of the Native Department throughout the experiment has been of great assistance, and is much appreciated.

## Agricultural Outlook.

The maize crop is now coming in, and preparations are being made for exporting the greater portion of what promises to be a record harvest. In all the principal maize growing areas the stands of plants to the acre are above the average of other years, and insect pests have done but little damage; leaf blight is noticeable in low-lying lands. The heaviest yields may be expected from the crops planted in November and the beginning of December, which confirms the results of experiments carried out at the Salisbury Experiment Station as well as the Gwebi Experiment Farm to test the effect of planting at different dates. Excellent crops of maize have been grown this year on the sand veld, particularly on land which was well manured. The natives in practically all districts have reaped good harvests, and could, if they were so disposed, store sufficient grain to carry them over a bad season. There is a shortage of labour in the Victoria and Penhalonga districts, and in view of the plentiful harvests this shortage may become more general. Wild animals, pigs and baboons in particular, have been a great nuisance this season, and we hear of a farmer in the Hartley district who removed from his lands seven wagon loads of green maize stalks the grain of which had been eaten by wild animals.

We are pleased to record another praiseworthy effort towards the extermination of Mexican marigold on the part of school children. In this instance the campaign was undertaken by the scholars of the Enkeldoorn Public School, who pulled up 60,829 roots during the season. The widespread existence of this weed more than ever calls for concerted action.\*

Wheat growers are busy planting their lands with the winter crop. The area sown would have been greater had prices been more attractive, or if some assurance had been given of the re-imposition of the duties suspended during the war. Winter wheat can be planted as late as the end of June, but if sown after May it runs the risk of not maturing before the rains commence. On a number of farms owing to late rains it was not possible to plough the vlei lands early in the year, and planting, perforce, has had to be postponed. In such instances early maturing varieties, such as Wit Klein Koren, Early Gluyas, Early Australian and Union 17, should be planted. Variety trials with winter cereals have been started this year at the Chindamora Native Industrial Mission, which is situated 28 miles north-east of Salisbury. Some 60 odd varieties have been planted, and the trials will be carried out under the supervision of the Department of Agriculture. Manurial experiments with winter cereals are also being conducted at the mission by the Chief Chemist, and it is hoped that in due course valuable data for the benefit of farmers will thus be obtained.

Cattle are thriving and generally are free from disease. The principal concern of breeders is the matter of markets, which is dealt with in the report of the Committee of Enquiry published in this issue. Prices at stock sales reflect the position very plainly, and it is evident that a crisis has very nearly been reached.

Horse-sickness has exacted a terrible toll in all parts of the Territory, the mortality at the end of March numbering 840 horses and 54 mules.

## Rates for Maize for Export via Beira.

The Railway Administration advise us that the following arrangements have been decided upon in regard to the current season's maize which will be available for export overseas *via* Beira.

Maize consigned from stations and sidings within 300 to 600 miles zone will be charged at rates according to the overseas C.I.F. prices, viz. :—

| Overseas C.I.F.<br>price per quarter. | Rate per ton<br>to Beira. |
|---------------------------------------|---------------------------|
| s. d.                                 | s. d.                     |
| 32 6 and under ... ..                 | 12 6                      |
| 32 7 to 37s. 6d. ... ..               | 15 0                      |
| Over 37s. 6d. ... ..                  | 17 6                      |

The rate of 15s. per ton will be charged in the first instance, and all consignors must forward to the Chief Accountant, Bulawayo, documentary evidence of the C.I.F. overseas selling price obtained, so that the original rail rate charged may be adjusted to conform with the above scale.



# Southern Rhodesia Veterinary Report.

February, 1923.

## AFRICAN COAST FEVER.

CHARTER DISTRICT.—Fresh outbreaks occurred on the farm Stockdale, the Mangeni and Narira Reserves. Mortality:—Wiltshire Estate, 2; Swartfontein, 3; Chipisa, 1; Tatton, 1; Rooipoort, 5; Stockdale, 10; Mangeni Reserve, 25; Narira Reserve, 15; Mooifontein, 2.

MELSETTER DISTRICT.—At the Merino infected centre there were five deaths.

## CONTAGIOUS ABORTION OF CATTLE.

One fresh centre of infection.

## SWEATING SICKNESS OF CALVES.

This affection was prevalent in the Mazoe, Lomagundi, Hartley, Nyamandhlovu, Inyati, Insiza, Bulawayo, Matobo and Gwanda districts.

## GALL SICKNESS (ANAPLASMOSIS OF CATTLE).

Promising results have been obtained from treatment by the intramuscular injection of mercuric chloride.

## HORSE-SICKNESS.

An extremely heavy infection exists throughout the Territory. The following mortality was reported:—Horses, 280; mules, 24.

## IMPORTATIONS.

From the Union of South Africa:—Bulls, 5; horses, 9; mules, 19; donkeys, 17; goats, 616; sheep, 1,215. From Portuguese East Africa:—Horse, 1; donkeys, 3.

## EXPORTATIONS.

To Union of South Africa:—Slaughter cattle, 1,368; pigs, 40. To Belgian Congo:—Sheep, 65. To Northern Rhodesia:—Sheep, 65; cows, 15; calves, 8; bull, 1. To Portuguese East Africa:—Sheep, 70; bull, 1; heifer, 1.

## March, 1923.

### AFRICAN COAST FEVER.

CHARTER DISTRICT.—A fresh outbreak occurred on the farm Hoffmania, which is a portion of the Nyamazaa Block, and about 25 miles west of the nearest infected centre. The appearance of the disease so far away from the other infected centres and so long after the original outbreak is most surprising. There is not the slightest clue as to how and when the disease was carried there, but as ticks cannot fly there must be some simple explanation, probably an illicit movement of cattle. The mortality during the month was as follows:—Chipisa, 6; Rooipoort, 2; Stockdale, 1; Mangeni Reserve, Homanhurst and Norah Lee, 8; Narira Reserve, 6; Mooifontein, 1; and Hoffmania, 11.

MELSETTER DISTRICT.—The infected herd on Merino was moved to clean veld on the farm Umzelezwe. The mortality at the other infected centres was seven head.

### ANTHRAX.

Two suspected cases were reported from Mtoko.

### TRYPANOSOMIASIS.

At the farm Pendragon in Melsetter district eight head of cattle died.

### CONTAGIOUS ABORTION OF CATTLE.

A fresh centre of infection was discovered in the Makoni district.

### MYIASIS (SCREW-WORM) OF CATTLE.

Notwithstanding the heavy rains this condition has been much less in evidence than in any year since its first appearance.

### SWEATING SICKNESS OF CALVES.

This affection was prevalent in the Salisbury, Hartley, Belingwe, Bulawayo, Plumtree, Matobo, Umzingwane, Bubi and Victoria districts.

### EPHEMERAL FEVER (THREE-DAY SICKNESS OF CATTLE).

This affection was prevalent in the Victoria and adjoining districts.

### HORSE-SICKNESS.

The exceptionally heavy infection continued throughout the month. The mortality reported was 470 horses and 23 mules.

### IMPORTATIONS.

From Union of South Africa:—Bulls, 20; heifers, 6; horse, 1; mules, 10; goats, 584; sheep, 1,489; pigs, 40.

## EXPORTATIONS.

To Union of South Africa:—Slaughter cattle, 1,077; horse, 1. To Belgian Congo:—Cows, 33; bulls, 7; calves, 115; sheep, 195. To Northern Rhodesia:—Horses, 2; bulls, 12; goats, 35; sheep, 70; pigs, 2. To Portuguese East Africa:—Bulls, 23; cows, 30; calf, 1; horse, 1.

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April, 1923.

## AFRICAN COAST FEVER.

CHARTER DISTRICT.—A fresh outbreak occurred on the farm Rockydale, which adjoins the previously infected farms, Rooipoort and Swartfontein. The mortality during the month was as follows:—Chipisa, 1; Rockydale, 2; Ferreiraaton, 2; Hoffmaniana, 5; Mangeni Reserve, 2; Narira Reserve, 2; Mooifontein, 1.

MELSETTER DISTRICT.—No deaths at any of the infected centres.

## CONTAGIOUS ABORTION OF CATTLE.

A fresh centre of infection was found in the Hartley district.

## EPHEMERAL FEVER (THREE-DAY SICKNESS OF CATTLE).

This affection was prevalent in various districts in a mild form.

## MYIASIS OF CATTLE (SCREW-WORM).

A few cases reported from Salisbury and adjoining districts, Bulawayo and Nyamandhlovu.

## CONTAGIOUS OPHTHALMIA OF CATTLE.

This disease is more prevalent than usual.

## HORSE-SICKNESS.

The mortality reported during the month was as follows:—Horses, 218; mules, 43; donkeys, 5.

## IMPORTATIONS.

From Great Britain:—Bull, 1; heifers, 4. From the Union of South Africa:—Bulls, 8; heifers, 3; horses, 35; mules, 29; donkeys, 20; sheep, 2,396; goats, 408; pigs, 15.

## EXPORTATIONS.

To Union of South Africa:—Slaughter cattle, 1,359; horse, 1. To Belgian Congo:—Goats, 60; sheep, 70. To Northern Rhodesia:—Donkeys, 33; goats, 30; sheep, 35. To Portuguese East Africa:—Horse, 1; mule, 1; goats, 25; sheep, 50.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

# Farming Calendar.

## June.

### BEE-KEEPING.

At this season hives require to be painted; the woodwork, being exceedingly dry, is in good condition to receive it. Linseed oil (unboiled) is the best kind to mix with white lead, as it is more penetrating, acting as a better preservative than boiled oil. Bees will be able to take beneficial flights during warm days, so that dysentery need not be anticipated.

### CITRUS FRUITS.

Cultivation of the grove is to be continued and pruning taken in hand towards the end of the month. Washington Navel oranges and some earlier varieties will be ready this month for gathering, packing and despatch.

### CROPS.

The harvesting of the smaller crops will now be over, except possibly ground-nuts, mangels and dhal. Ground-nuts should be lifted before the first frosts. Mangels may safely be allowed to remain in the ground until required for use. Dhal will not be ripe until the end of the month, when the plants should be cut about a foot above the ground, allowed to dry for a few days, then shaken to free the seeds from the pods. Ploughing should be continued through the month, and, if the maize is cut and stooked, the fields can be ploughed between the lines of stooks.

### DAIRYING.

With the advent of the winter months, dairy produce is not so liable to perish as in the hotter months. Cream producers can with advantage produce cream for the factories containing a slightly lower fat percentage, as cream is not so likely to go sour on account of lower atmospheric temperatures. With regard to next season's milk or cream supply, dairy farmers must ensure that the dairy cows are kept in good condition throughout the winter months, so that they can produce milk immediately after calving, and not require the first two months' fresh grass to bring them into condition, thereby losing what should be the best weeks of their production. A cow gives her utmost in milk from four to six weeks after calving, but she must be in good condition to do this.

### DECIDUOUS FRUITS.

Pruning of deciduous trees should be done this month or in July.

### ENTOMOLOGICAL.

*Cabbage Family.*—Plants of this family suffer from cabbage louse and Bagrada bug during June.

*Onions.*—Suffer from thrip. The transplants may be dipped as far as the roots in tobacco wash or paraffin emulsion to keep down the pest.

*Fig.*—The winter crop of fruit is liable to suffer from fig weevil. The infested fruit should be collected and destroyed. If this has been done regularly with the first crop, the second crop is not likely to suffer much.

## FLOWER GARDEN.

Annuals for early spring flowering should be sown, preferably in paraffin tins cut lengthwise, in a place sheltered from the wind. Perennials, shrubs and ornamental tree seeds may also be sown. Fruit trees, shrubs and roses should be pruned and all dead wood removed. Sweet peas require constant attention.

## VEGETABLE GARDEN.

All the available space in the garden should now be thoroughly trenched and manured, the soil being well worked and loosened. Vegetables planted out for winter crops should be well and continuously cultivated, which will help to bring them along quicker and with less watering. Late-bearing tomatoes should be sheltered from the cold winds by a grass shield. Beet, radish, carrot, parsnip, turnip, onion, leek, mustard, cress and tomatoes may be planted.

## FORESTRY.

Burn out the grass in any fire traps round or near the plantation that were left unploughed. Any timber that is to be felled should be taken in hand this month.

## GENERAL.

Grazing is giving out, and the next few months will be a period of difficulty for the rancher. It is a mistake, frequently seen, for all the grazing nearest to the drinking places to be first consumed, so that later on the cattle, when least able to endure fatigue and when the grass is in any case most scanty and dry, have furthest to walk from the feeding ground to water. A little forethought can obviate this trouble. Live stock are usually in good condition at this time of year and able to travel longer distances to water than may be the case later on in the season. Fire guards to prevent grass fires should be looked to.

## POULTRY.

The nights during this and next month may be cold, and those whose fowls are housed in iron houses would do well to surround them and cover the roof with grass, otherwise the sudden fall in temperature may lower the egg yield. Brick, pisé de terre and other thick-walled houses with thatched roofs are more suitable for cold nights. See that the hens do not become too fat, and that they and the male bird are kept free from insects; see especially to the feeding of the male. He must be kept in good condition; feed him separately at mid-day, and give him a piece of raw meat the size of a walnut three or four times a week.

Do not force the breeding birds for eggs; this only results in unfertile eggs, poor hatches and weak chicks, and ruins the constitution of the birds. No birds, in fact, should be given anything of a forcing nature, such as spices and condiments.

Some of the young stock should now be over two months old, and coming along well. Give them as much range, exercise and food as possible. They must, too, have comfortable, airy houses, kept clean and free from insects, to develop into good birds.

Hatch all the turkey eggs possible from now on to six weeks before the rainy season commences.

## STOCK.

*Cattle.*—Where it is necessary to move cattle to fresh pasturage, this should not be unduly delayed. Dipping is best postponed during very cold snaps until a warm day occurs. Cows with autumn calves should be kept in the more sheltered paddocks. A watchful eye should be kept on all watering places in order to prevent their being fouled or stopped up. Bulls should be kept out of the herd until the end of July at least, and, in the meantime, they should be well fed and cared

for in order to fit them for their work. The three watchwords in the dairy herd should be feed, shelter and bedding from now onwards. Ensilage will now be found invaluable, as also will pumpkins, majordas or any other form of succulent food. Good hay should be used to rack up with at night, and the maize ration should be supplemented with ground-nuts, ground-nut cake or bean meal. Young calves are better in the pens on very cold mornings until the sun has gained some power, when they may run on short sweet veld for a few hours. The above remarks with regard to dipping and water supply apply equally to dairy as to ranching herds.

*Sheep.*—Sheep are best kept on the high veld for a while longer. If grass seeds are troublesome, a grazing area should be mown. If the rams were put into the flock in May, they should now be removed. Ewes with lambs will benefit by a few handfuls of mealies, and perhaps ensilage. They should be provided with shelter from cold winds.

#### VETERINARY.

Horse-sickness should be practically over now. Redwater and gall-sickness occur all the year round, but the worst time is the summer, when ticks are prevalent. Blue tongue should be very little in evidence now. After twelve months in this Territory, sheep do not contract the disease. Inoculation can be carried out now. Scab is a poverty winter disease.

#### WEATHER.

Casual rains may occur, but except on the eastern frontier, none is to be reckoned upon, nor can it be regarded as seasonable or desirable. Frosts generally occur on a few nights during the month of June, and precautions must therefore be taken. This month and the next are the coldest of the year, and when the cold is accompanied by dull weather or "Scotch mist," known locally as "guti," it is apt to have a severe effect on live stock, especially if grazing should at the same time be scarce and water supplies far to travel to.

### July.

#### BEE-KEEPING.

The warmer bees are kept during this month so much the stronger will they come out in the spring. Provide a thickness of 3 inches of cloth coverings over the frames, and where quilts are, on examination, found to be damp, replace them with dry ones. This is a favourable season to carry out repairs to hives. All section and shallow frame combs must be carefully stored away from ants and mice, as these will be wanted for the excellent honey to be stored in them next October, collected from the bush bloom.

#### CITRUS FRUITS.

Orange trees should be pruned this month, if this work is not completed. Groves must be well cultivated, especially after irrigation has taken place, and the soil round the trees hoed or dug over. Washington Navels will be gathered and some later varieties will be ready for picking. The irrigation of orange trees should be taken in hand when the trees are ready to commence the next growth.

#### CROPS.

See June.

#### DAIRYING.

See June.

## DECIDUOUS FRUITS.

Pruning may be done this month.

## ENTOMOLOGICAL.

*Onions.*—Thrip is liable to affect this crop, and when present calls for careful attention. Tobacco wash or paraffin emulsion should be used.

*Deciduous Fruits.*—Scale infested trees may receive a winter wash during this month. Lime sulphur salt wash or scalecide is recommended for this purpose.

*Guava.*—Citrus growers should always bear in mind that this fruit harbours citrus codling when there is no citrus fruit available. All guava trees, therefore, in the vicinity of citrus orchards should be stripped during this or next month, and the fruit buried deeply or burnt.

*Fig.*—Fig weevil may still be in evidence. The fruit is also sometimes attacked by citrus codling and other moths. The destruction of infested fruit is the most practical remedy for the pests.

## FLOWER GARDEN.

Seeds of most annuals, perennials, shrubs and ornamental trees may be sown. The pruning of roses should be attended to early. Dahlias and other summer-flowering bulbs should be taken up, divided and replanted. Sweet peas require attention and staking.

## VEGETABLE GARDEN.

Sow turnips, beans, peas, onions, cabbage, beet, carrots, parsnips, radishes, lettuce and spinach.

## FORESTRY.

Cuttings of all ornamental shrubs, roses, etc., should be taken now before the spring growth starts. Plants grown in tins during the previous season should be re-potted as soon as the cold weather is over.

## GENERAL.

Veld fires must be watched for and arrangements made to combat them. The loss that may result and the penalties under the Herbage Preservation Ordinance are to be borne in mind. Fire guards should this month be burnt round all grazing which it is desired to preserve for use later on.

## POULTRY.

Watch the chicks carefully; it is the little details in chicken rearing that count. Never allow the air in the brooders to become foul. If the chicks in the brooders crowd one on top of the other, they are either too cold or lack sufficient fresh air. If they are cheeping and shivering, they should have more warmth. If they are gasping and their wings droop, they are too hot, and require more fresh air and ventilation. If they sleep spread out over the floor of the brooder, they are all right.

Avoid over-crowding at night; it is the cause of more deaths, weak chicks and poor stock than almost anything else.

When sending hatching eggs away, see that they are carefully packed and in such a manner as to reduce vibration to a minimum. It must be remembered that the germ of an egg is very delicate. Also always contract to have unfertiles returned after ten days, that is after the first testing, for many buying hatching eggs imagine that if an egg does not hatch it is necessarily unfertile, and wish such replaced. Those who buy hatching eggs should rest them for 24 to 36 hours before putting them into the incubator or under a hen. If this is not done, a poor hatch is the result.

Ducks should always sleep on dry bedding, which should be changed every alternate day. Wet, dirty bedding means cramp, rheumatism and no eggs. If you are going in for ducks, keep good ones; they lay better, and in every way are more profitable than cross-bred ones.

The hatching season is drawing to a close; don't hatch any chicks after the end of next month, but between now and then hatch as many as possible.

#### STOCK.

*Cattle.*—On ranches the advice given for June applies still. The bulls may again be put into the herd at the end of the month. If grazing has been reserved for the winter months, it will probably be wise to turn the cattle into it now. Watch for any unthrifty cattle, and get them into the home paddock and feed them before they become really poor. Dairy cattle will require heavy feeding now, and if plenty of roughage is available, cows in milk will do better if kept in for a while on cold mornings and turned out only after the warmth of the sun is felt.

*Sheep.*—Vleis should now be fairly dry and may be utilised; otherwise the advice given for June applies.

#### VETERINARY.

Horse-sickness and blue tongue should now have disappeared. Redwater and gallsickness occur all the year round, but the worst time is during the summer, when ticks are prevalent. Sheep may be inoculated against blue tongue now. Scab in sheep will probably be in evidence this month.

#### WEATHER.

Though rains have fallen during every month of the year in Rhodesia, none are looked for or desired this month. Most stations record an average of .01 to .3 inch over a number of years. Severe cold is likely to occur at this time of year, the lowest temperatures occurring an hour or two before sunrise. Frosts may be looked for, especially on calm clear nights. Cold windy days and damp "guti" weather tell severely on cattle, if shelter and food are not provided.

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## Milking Competition, Salisbury Show.

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The Rhodesia Agricultural Society is again awarding valuable money prizes for the prize winners in the milking competition to be held on the show grounds, Salisbury, during the two days, 12th and 13th August, immediately preceding the show. It is to be hoped that the entries will be as numerous this year as they were at the 1922 show. Great interest was taken in this competition in previous years, and it is by having a large entry and keen competition that the interest is maintained.



## Southern Rhodesia Weather Bureau.

MARCH AND APRIL, 1923.

*Pressure.*—During the month of March the mean barometric pressure was below normal over the whole country, and varied from 0.07 inch below normal at Salisbury to 0.01 inch below normal at Gwelo. The fluctuations in the barometric pressure during the month were large, the maximum range varying from 0.20 inch at Bulawayo and Umtali to 0.17 inch at Salisbury and Gwelo. High pressure areas were present on the 13th to 20th, 25th to 27th and 30th to 31st; the maximum high was 0.08 inch above normal at Gwelo on the 16th. The minimum low was 0.15 inch below normal at Salisbury on the 6th.

During April the mean barometric pressure was below normal over the whole country, and varied from 0.06 inch below normal at Salisbury to 0.01 inch below normal at Gwelo. The fluctuations in barometric pressure during the month were large, the maximum range varying from 0.21 inch at Umtali to 0.16 inch at Salisbury. High pressure areas were present from the 1st to 3rd and from the 23rd to 27th; the maximum high was 0.06 inch above normal at Bulawayo on the 2nd. The minimum low was 0.15 inch below normal at Salisbury on the 13th.

*Temperature.*—During March the mean temperature varied from 0.5 deg. above normal at Salisbury to 1.0 deg. below normal at Gwelo. The mean daily temperature varied from 0.3 deg. below normal at Salisbury to 5.1 deg. below normal at Gwelo, whilst the mean night temperature varied from 4.3 deg. above normal at Gwelo to 1.3 deg. above normal at Bulawayo.

During April the mean temperature varied from 1.1 deg. above normal at Salisbury to 1.5 deg. below normal at Bulawayo. The mean daily temperature varied from 2.3 deg. above normal at Salisbury to 4.1 deg. below normal at Umtali, whilst the mean night temperature varied from 2.0 deg. above normal at Umtali to 0.8 deg. below normal at Bulawayo.

**March Rainfall.**—During March the rainfall was greatly above normal over the whole country. The mean rainfall recorded in the various zones during March was as under; the previous greatest mean rainfall recorded during this month, and the year in which it occurred, are also given:—

|               | Mean rainfall<br>March, 1923. | Mean normal<br>March rainfall. | Previous<br>greatest<br>mean rainfall<br>in March. | Year. |
|---------------|-------------------------------|--------------------------------|----------------------------------------------------|-------|
| Zone A ... .. | 8.02                          | 2.77                           | 7.14                                               | 1910  |
| Zone B ... .. | 8.20                          | 2.47                           | 5.84                                               | 1918  |
| Zone C ... .. | 13.32                         | 4.14                           | 7.35                                               | 1910  |
| Zone D ... .. | 12.81                         | 4.64                           | 8.64                                               | 1909  |
| Zone E ... .. | 14.32                         | 4.19                           | 8.00                                               | 1909  |
| Zone F ... .. | 22.62                         | 7.86                           | 23.34                                              | 1917  |

This table shows that the mean rainfall during March, 1923, was the heaviest on record for that month in all zones except Zone F.

*In Zone A* the district with the greatest mean rainfall was Gwelo with 11.58 inches, and the least favoured district was Wankie with 4.10 inches. The heaviest rainfall during the month was 12.91 inches at Dawn (Gwelo district), and the least was 3.91 inches at Waterford (Wankie district).

*In Zone B* the district with the greatest mean rainfall was Belingwe with 11.11 inches, and the least favoured district was Gwanda with 2.80 inches. The heaviest rainfall during the month was 12.41 inches recorded at Essexvale (Umzingwane district), and the least was 0.74 inch at Limpopo (Gwanda district).

*In Zone C* the district with the greatest mean rainfall was Charter with 16.31 inches, and the least favoured district was Lomagundi with 10.64 inches. The heaviest rainfall during the month was 21.31 inches recorded at Bushy Park (Charter district), and the least 7.48 inches at Argyle (Lomagundi district).

*In Zone D* the district with the greatest mean rainfall was Inyanga with 16.63 inches, and the least favoured district was Mtoko with 8.50 inches. The heaviest rainfall during the month was 20.07 inches at Inyanga (Inyanga district), and the least 7.06 inches at Makaha (Mtoko district).

*In Zone E* the district with the greatest mean rainfall was Melsetter with 21.41 inches, and the least favoured district was Chibi with 6.31 inches. The greatest rainfall during the month was 25.25 inches at Stapleford (Umtali district), and the least 5.72 inches at Summer-ton (Victoria district).

*In Zone F* the heaviest rainfall was 26.41 inches at Hoboken (Umtali district), and the least was 15.75 inches at Chipinga (Melsetter district).

**April Rainfall.**—During April the rainfall was below normal over the whole country. Practically no rain was recorded in Matabeleland, and very little, mostly in scattered showers, in Mashonaland.

*In Zone A* rain was only reported from one station, namely, Gokwe with 0.02 inch.

*In Zone B* few stations reported rain; those reporting varied from

0.80 inch at Umfula (Matobo district) to 0.02 inch at Garth (Bulalima district).

*In Zone C* the rainfall varied from 3.33 inches at Dingley Dell (Lomagundi district) to 0.01 inch at Hallingbury and Jenkinstown.

*In Zone D* the rainfall varied from 5.03 inches at Kingston (Mazoe district) to 0.20 inch at Makaha (Mtoko district).

*In Zone E* the rainfall varied from 4.48 inches at Stapleford (Umtali district) to 0.06 inch at Msali (Victoria district).

*In Zone F* the rainfall varied from 1.69 inches at Chipinga (Melssetter district) to 1.18 inches at Chikore.

**General Summary.**—As April is practically the end of the rainy season, a general review of the past season will be of interest. Scattered light showers were first reported on the 29th September and early rains set in generally at the beginning of October. Good rains were reported generally from the 1st to the 18th of the month, and in Matabeleland from the 23rd to the 25th. During November the mean rainfall was below normal over the whole country, with the exception of Zone D, slight showers only being reported. During December the mean rainfall was below normal over the whole country. Only light showers were reported up to the 20th, when general heavy rains set in. During January the mean rainfall was above normal except in Zone D. Rain was general throughout the month except from the 1st to the 6th, when only light showers were reported. February was another wet month, rain being general throughout the month; whilst, as we have seen, the March rainfall was the heaviest recorded for that month. The mean rainfall recorded in the various zones from July to April is as under:—

|               | Mean<br>rainfall,<br>July-April. | Normal<br>mean<br>rainfall,<br>July-April. | Greatest<br>recorded<br>mean rainfall<br>for period. | Year.   |
|---------------|----------------------------------|--------------------------------------------|------------------------------------------------------|---------|
| Zone A ... .. | 30.58                            | 24.10                                      | 36.24                                                | 1914-15 |
| Zone B ... .. | 30.96                            | 20.83                                      | 39.47                                                | 1914-15 |
| Zone C ... .. | 40.90                            | 30.65                                      | 45.54                                                | 1917-18 |
| Zone D ... .. | 47.11                            | 33.04                                      | 50.52                                                | 1917-18 |
| Zone E ... .. | 44.51                            | 31.12                                      | 61.40                                                | 1917-18 |
| Zone F ... .. | 74.38                            | 49.91                                      | 109.77                                               | 1917-18 |

## RAINFALL.

| STATION.               | 1923.  |        | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|------------------------|--------|--------|-------------------------------|--------------------------------------------|
|                        | March. | April. |                               |                                            |
| ZONE A.:               |        |        |                               |                                            |
| Bubi—                  |        |        |                               |                                            |
| Imbesu Kraal ... ..    | 9.95   | —      | 34.04                         | 23.65                                      |
| Inyati ... ..          | 6.80   | ...    | ...                           | 23.75                                      |
| Maria Farm ... ..      | 9.75   | —      | 31.42                         | n.s.                                       |
| Shangani Estate ... .. | 10.11  | —      | 34.83                         | 22.41                                      |
| Bulalima—              |        |        |                               |                                            |
| Kalaka ... ..          | 6.90   | —      | 31.60                         | 21.66                                      |
| Riverbank ... ..       | 6.15   | —      | 23.30                         | 22.78                                      |
| Bulawayo—              |        |        |                               |                                            |
| Fairview Farm ... ..   | 8.69   | —      | 36.66                         | 22.25                                      |
| Keendale ... ..        | 7.00   | —      | 30.01                         | 20.15                                      |
| Lower Rangemore ... .. | 11.70  | —      | 38.16                         | 23.36                                      |
| Observatory ... ..     | 8.24   | —      | 35.15                         | 23.29                                      |
| Gwelo—                 |        |        |                               |                                            |
| Dawn ... ..            | 12.91  | ...    | ...                           | 26.19                                      |
| Somerset Estate ... .. | 10.25  | ...    | ...                           | 24.31                                      |
| Insiza—                |        |        |                               |                                            |
| Thornville ... ..      | 7.20   | ...    | ...                           | 25.92                                      |
| Nyamandhlovu—          |        |        |                               |                                            |
| Gwaai Reserve ... ..   | 4.07   | —      | 42.08                         | n.s.                                       |
| Impondeni ... ..       | 9.98   | —      | 33.73                         | n.s.                                       |
| Naseby ... ..          | 8.33   | ...    | ...                           | 23.64                                      |
| Paddy's Valley ... ..  | 10.15  | —      | 34.69                         | 23.14                                      |
| Wankie—                |        |        |                               |                                            |
| Lynwood ... ..         | 4.28   | —      | 21.12                         |                                            |
| Waterford ... ..       | 3.91   | —      | 34.55                         | 23.36                                      |
| Sebungwe—              |        |        |                               |                                            |
| Gokwe ... ..           | 9.25   | 0.02   | 36.99                         | 29.62                                      |
| ZONE B.:               |        |        |                               |                                            |
| Belingwe—              |        |        |                               |                                            |
| Bickwell ... ..        | 11.11  | 0.20   | 32.31                         | 20.72                                      |
| Bubje Ranch ... ..     | ...    | ...    | ...                           | n.s.                                       |
| Bulalima—              |        |        |                               |                                            |
| Edwinton ... ..        | 8.73   | —      | 29.67                         | 21.08                                      |
| Garth ... ..           | 4.44   | 0.02   | 26.87                         | 25.13                                      |
| Maholi ... ..          | ...    | ..     | ...                           | 25.78                                      |
| Retreat ... ..         | 5.29   | —      | 27.85                         | 20.52                                      |
| Sandown ... ..         | 7.18   | —      | 33.07                         | n.s.                                       |
| Tjompanie ... ..       | 7.52   | —      | 26.20                         | 23.33                                      |
| Gwanda—                |        |        |                               |                                            |
| Gwanda Gaol ... ..     | 5.67   | 0.02   | 27.56                         | 20.26                                      |
| Insindini ... ..       | ...    | ...    | ...                           | n.s.                                       |
| Limpopo ... ..         | 0.74   | —      | 20.68                         | n.s.                                       |
| Tuli ... ..            | 1.77   | —      | 16.11                         | 14.39                                      |
| Insiza—                |        |        |                               |                                            |
| Albany ... ..          | 9.02   | 0.09   | 34.04                         | 20.56                                      |
| Filabusi ... ..        | 4.33   | ...    | ...                           | 21.00                                      |
| Fort Rixon ... ..      | 10.77  | ...    | ...                           | 21.28                                      |
| Infiningwe ... ..      | 11.92  | 0.10   | 43.13                         | 25.22                                      |
| Lancaster ... ..       | 11.32  | ...    | ...                           | n.s.                                       |

## RAINFALL—(Continued).

| STATION.                   | 1923.  |        | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|----------------------------|--------|--------|-------------------------------|--------------------------------------------|
|                            | March. | April. |                               |                                            |
| ZONE B.—(Continued)        |        |        |                               |                                            |
| Matobo—                    |        |        |                               |                                            |
| Holly's Hope ...           | ...    | ...    | ...                           | 21.93                                      |
| Matopo Mission ...         | 10.29  | 0.11   | 36.10                         |                                            |
| Mtshabezi Mission ...      | 5.12   | 0.20   | 30.51                         | 22.17                                      |
| Rhodes Matopo Park ...     | 8.41   | ...    | ...                           |                                            |
| Umfula ...                 | 7.50   | 0.80   | 27.14                         | n.s.                                       |
| Umzingwane—                |        |        |                               |                                            |
| Essexvale ...              | 12.41  | —      | 41.11                         | 23.65                                      |
| Koithwayo ...              | 9.75   | ...    | ..                            | n.s.                                       |
| ZONE C.:                   |        |        |                               |                                            |
| Charter—                   |        |        |                               |                                            |
| Bushy Park ...             | 21.31  | ...    | ...                           | 25.91                                      |
| Enkeldoorn ...             | 13.94  | 0.13   | 35.46                         | 28.81                                      |
| Marshbrook ...             | 13.63  | —      | 33.84                         | 28.87                                      |
| Range ...                  | 18.05  | 0.10   | 42.97                         | 31.00                                      |
| Umniati ...                | 12.70  | ...    | ...                           | 23.30                                      |
| Vrede ...                  | 18.24  | ...    | ...                           | 28.70                                      |
| Chilimanzi—                |        |        |                               |                                            |
| Allanberry ...             | 15.31  | 0.10   | 38.02                         |                                            |
| Central Estates ...        | 15.81  | ...    | ...                           | 28.20                                      |
| Gwelo—                     |        |        |                               |                                            |
| Cross Roads ...            | 11.33  | ...    | ...                           | 24.81                                      |
| East Clare Ranch ...       | 10.58  | ...    | ...                           | n.s.                                       |
| Globe and Phoenix Mine ... | 8.99   | —      | 34.73                         | 28.41                                      |
| Gwelo Gaol ...             | 14.17  | 0.01   | 42.41                         | 25.78                                      |
| Indiva ...                 | 14.76  | —      | 40.43                         | n.s.                                       |
| Lyndene ...                | 10.42  | 0.80   | 38.08                         | n.s.                                       |
| Rhodesdale Ranch ...       | 18.26  | ...    | ...                           | 25.96                                      |
| Hartley—                   |        |        |                               |                                            |
| Ardgowan ...               | 17.21  | 0.07   | 44.05                         | 30.50                                      |
| Balwearie ...              | 9.67   | 0.35   | 39.72                         | n.s.                                       |
| Beatrice... ..             | 12.03  | 0.30   | 40.42                         | 28.30                                      |
| Carnock ...                | 11.23  | 0.66   | 44.51                         | 31.00                                      |
| Philippaugh ...            | 11.33  | 0.25   | 42.83                         | 31.10                                      |
| Cromdale ...               | 11.74  | 0.28   | 41.34                         | n.s.                                       |
| Elvington ...              | 15.85  | ...    | ...                           |                                            |
| Gatooma ...                | 11.92  | —      | 40.27                         | 30.97                                      |
| Gowerlands ...             | 12.90  | 0.34   | 42.17                         | 29.55                                      |
| Hallingbury ...            | 9.81   | 0.01   | 37.58                         | 27.77                                      |
| Hartley Gaol ...           | 7.57   | ...    | ...                           | 32.06                                      |
| Hopewell ...               | 10.30  | 0.13   | 39.22                         | 26.94                                      |
| Jenkinson ...              | 12.07  | 0.01   | 40.68                         | 29.27                                      |
| Ranwick ...                | 12.56  | 0.30   | 42.53                         | 29.60                                      |
| Spitzkop ...               | ...    | ...    | ...                           | 30.06                                      |
| Lomagundi—                 |        |        |                               |                                            |
| Argyle ...                 | 7.48   | 0.65   | 38.54                         | 32.94                                      |
| Baguta ...                 | 14.86  | 1.43   | 54.51                         |                                            |
| Citrus Estate ...          | 11.68  | 1.14   | 44.49                         |                                            |
| Darwendale ...             | 11.62  | 0.52   | 38.31                         | 30.77                                      |

## RAINFALL—(Continued).

| STATION.                        | 1923.  |        | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|---------------------------------|--------|--------|-------------------------------|--------------------------------------------|
|                                 | March. | April. |                               |                                            |
| ZONE C.—(Continued)             |        |        |                               |                                            |
| Lomagundi (Continued)—          |        |        |                               |                                            |
| Dingley Dell ...                | 10.26  | 3.33   | 43.53                         | n.s.                                       |
| Freda ...                       | 8.72   | 1.43   | 40.40                         | n.s.                                       |
| Gambuli ...                     | 8.92   | 0.76   | 42.06                         |                                            |
| Gungurubee ...                  | 9.74   | ...    | ...                           |                                            |
| Impingi... ..                   | 11.62  | 0.78   | 47.01                         | n.s.                                       |
| Lone Cow Estate ...             | 9.13   | ...    | ...                           | 33.57                                      |
| Mafoota ...                     | 11.35  | 0.76   | 46.74                         | n.s.                                       |
| Maningwa ...                    | 12.83  | 0.33   | 55.49                         | 34.88                                      |
| Mapandagutu ...                 | 8.35   | ...    | ...                           | n.s.                                       |
| Mukwe River Ranch ...           | 15.58  | 2.73   | 43.30                         | 30.84                                      |
| Nyapi ...                       | 9.17   | ...    | ...                           | n.s.                                       |
| Nyaroro ...                     | 9.95   | ...    | ...                           | n.s.                                       |
| Nyati ...                       | 9.77   | 2.10   | 40.09                         | n.s.                                       |
| Palm Tree Farm ...              | 11.73  | 2.26   | 36.16                         | 32.16                                      |
| Richmond ...                    | 12.56  | ...    | ...                           | n.s.                                       |
| Sangwe ...                      | 10.09  | 1.66   | 48.38                         | n.s.                                       |
| Silalater Estate ...            | 8.61   | 1.49   | 47.55                         | n.s.                                       |
| Sinoia ...                      | 11.74  | —      | 47.08                         | 31.00                                      |
| Sipolilo ...                    | 7.98   | —      | 44.52                         | 31.14                                      |
| Talfourd ...                    | ...    | 1.68   | ...                           | 32.14                                      |
| Umboe ...                       | 12.66  | 1.47   | 46.46                         | n.s.                                       |
| Umvukwe Ranch ...               | 10.78  | ...    | ...                           | 33.18                                      |
| Salisbury—                      |        |        |                               |                                            |
| Avondale ...                    | 11.98  | 0.60   | 42.76                         | 31.43                                      |
| Botanical Experiment Station... | 11.97  | 0.51   | 41.42                         | 32.84                                      |
| Bromley ...                     | 11.24  | 2.05   | 45.13                         | 33.15                                      |
| Cleveland Dam ...               | 13.85  | ...    | ...                           | 30.30                                      |
| Gwebi ...                       | 10.65  | ...    | ...                           | 33.88                                      |
| Hillside ...                    | 12.53  | 1.96   | 43.04                         | 29.84                                      |
| Lilfordia ...                   | 11.80  | ...    | ...                           | 29.80                                      |
| Lochinvar ...                   | 12.56  | 1.24   | 39.63                         | n.s.                                       |
| Manor Farm ...                  | 10.72  | 2.19   | 47.33                         | n.s.                                       |
| Salisbury Gaol ...              | 11.45  | 1.37   | 45.03                         | 32.10                                      |
| Sebastopol ...                  | 14.50  | 0.99   | 48.37                         | 33.30                                      |
| Selby ...                       | 11.69  | 0.53   | 49.30                         | 29.41                                      |
| Stapleford ...                  | 11.50  | 0.95   | 53.17                         | 33.38                                      |
| Tisbury ...                     | 13.31  | ...    | ...                           | n.s.                                       |
| Vainona ...                     | 14.92  | 0.67   | 47.81                         | 33.50                                      |
| Sebungwe—                       |        |        |                               |                                            |
| Sikombela ...                   | 12.34  | —      | 37.53                         | 28.39                                      |
| ZONE D.:                        |        |        |                               |                                            |
| Darwin—                         |        |        |                               |                                            |
| La Belle Esperance...           | 8.88   | 1.70   | 36.42                         | n.s.                                       |
| Mount Darwin ...                | 8.77   | ...    | ...                           | 30.80                                      |
| Inyanga—                        |        |        |                               |                                            |
| Inyanga ...                     | 20.07  | 1.63   | 57.77                         | 36.63                                      |
| Juliasdale ...                  | 18.17  | 2.37   | 56.16                         | n.s.                                       |
| Rhodes Estate ...               | 14.49  | ...    | ...                           | 35.96                                      |
| York ...                        | 13.79  | ...    | ...                           |                                            |

## RAINFALL—(Continued).

| STATION.                | 1923.  |        | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|-------------------------|--------|--------|-------------------------------|--------------------------------------------|
|                         | March. | April. |                               |                                            |
| ZONE D (Continued)      |        |        |                               |                                            |
| Makoni—                 |        |        |                               |                                            |
| Eagle's Nest            | ...    | 14.14  | ...                           | 32.64                                      |
| Forest Hill             | ...    | 11.25  | 0.62                          | 39.65                                      |
| Riversdale...           | ...    | 16.44  | 1.94                          | 49.28                                      |
| Wensleydale             | ...    | 16.76  | 1.70                          | 53.01                                      |
| Mazoe—                  |        |        |                               |                                            |
| Atherstone              | ...    | 18.35  | ...                           | n.s.                                       |
| Avonduur                | ...    | 15.31  | ...                           | 34.94                                      |
| Benridge                | ...    | ...    | ...                           | 34.36                                      |
| Bindura                 | ...    | 11.90  | 4.10                          | 49.40                                      |
| Ceres                   | ...    | 15.53  | ...                           | 38.21                                      |
| Chipoli                 | ...    | 8.84   | 2.98                          | 43.14                                      |
| Citrus Estate           | ...    | 8.73   | 2.59                          | 45.26                                      |
| Craigengower            | ...    | 10.97  | ...                           | 35.48                                      |
| Glen Divis              | ...    | 12.83  | 4.46                          | 52.52                                      |
| Great B...              | ...    | 11.85  | ...                           | n.s.                                       |
| Kilmer                  | ...    | 11.20  | 1.86                          | 47.97                                      |
| Kingston                | ...    | 12.22  | 5.03                          | 55.61                                      |
| Mazoe                   | ...    | 10.25  | 1.20                          | 43.81                                      |
| Marienzi                | ...    | 13.58  | 3.22                          | 36.76                                      |
| Marston...              | ...    | 11.26  | ...                           | n.s.                                       |
| Mgutu                   | ...    | 12.09  | 1.21                          | 50.63                                      |
| Omeath                  | ...    | 13.49  | ...                           | 31.90                                      |
| Pearson Settlement      | ...    | 11.99  | ...                           | n.s.                                       |
| Ruia                    | ...    | 9.48   | 1.92                          | 47.11                                      |
| Ruoko Ranch             | ...    | 11.00  | 1.27                          | 46.11                                      |
| Shamva                  | ...    | 9.98   | 2.00                          | 43.11                                      |
| Stanley Kop             | ...    | 14.08  | 1.65                          | 43.70                                      |
| Sunnyside               | ...    | 11.12  | 4.47                          | 49.95                                      |
| Teign                   | ...    | 9.21   | 2.67                          | 45.46                                      |
| Usk                     | ...    | 15.53  | ...                           | n.s.                                       |
| Virginia                | ...    | 14.69  | 2.33                          | 55.94                                      |
| Visa                    | ...    | 14.37  | ...                           | n.s.                                       |
| Woodlands               | ...    | 12.82  | 4.28                          | 55.26                                      |
| Zombi                   | ...    | 13.40  | 3.86                          | 49.35                                      |
| Mrewa—                  |        |        |                               |                                            |
| Glen Somerset           | ...    | ...    | ...                           | 35.30                                      |
| Mrewa                   | ...    | 13.71  | ...                           | 39.90                                      |
| Selous Nek              | ...    | 16.19  | 3.02                          | 49.02                                      |
| Mtoko—                  |        |        |                               |                                            |
| Makaha                  | ...    | 7.06   | 0.20                          | 43.30                                      |
| Mtoko                   | ...    | 9.85   | 0.72                          | 34.10                                      |
| Salisbury—              |        |        |                               |                                            |
| Arcturus                | ...    | 14.42  | ...                           | n.s.                                       |
| Chindamora Reserve      | ...    | 11.25  | ...                           | n.s.                                       |
| Glenara                 | ...    | 12.50  | ...                           | 31.12                                      |
| Goromonzi               | ...    | 11.37  | ...                           | 38.42                                      |
| Hatchliffe (Borrowdale) | ...    | 17.75  | ...                           | 34.78                                      |
| Hillside (Bromley)      | ...    | 10.27  | 1.98                          | 43.85                                      |
| Kilmuir                 | ...    | 14.85  | ...                           | n.s.                                       |
| Meadows                 | ...    | 15.49  | 0.55                          | 59.38                                      |

## RAINFALL—(Continued).

| STATION.               | 1923.  |        | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|------------------------|--------|--------|-------------------------------|--------------------------------------------|
|                        | March. | April. |                               |                                            |
| ZONE D.—(Continued)    |        |        |                               |                                            |
| Salisbury (Continued)— |        |        |                               |                                            |
| Rastenburg ...         | 14.10  | ...    | ...                           | n.s.                                       |
| Springs ...            | 15.92  | ...    | ...                           | n.s.                                       |
| ZONE E.:               |        |        |                               |                                            |
| Belingwe—              |        |        |                               |                                            |
| Belingwe ...           | 7.20   | 0.14   | 30.89                         | 28.25                                      |
| Inferno Ranch ...      | ...    | ...    | ...                           | n.s.                                       |
| Shabani ...            | 10.99  | ...    | ...                           | n.s.                                       |
| Bikita—                |        |        |                               |                                            |
| Angus Ranch ...        | 10.72  | ...    | ...                           | n.s.                                       |
| Bikita ...             | 21.47  | 1.15   | 53.28                         | 58.99                                      |
| Devuli Ranch ...       | ...    | ...    | ...                           | n.s.                                       |
| Charter—               |        |        |                               |                                            |
| Buhera ...             | 17.53  | 0.80   | 41.84                         | 29.88                                      |
| Riversdale ...         | 19.44  | ...    | ...                           | n.s.                                       |
| Chibi—                 |        |        |                               |                                            |
| Chibi ...              | 6.31   | ...    | ...                           | 24.42                                      |
| Chilimanzi—            |        |        |                               |                                            |
| Chilimanzi ...         | 13.65  | ...    | 46.79                         | 26.62                                      |
| Driefontein ...        | ...    | ...    | ...                           | 26.61                                      |
| Felixburg ...          | 13.19  | ...    | ...                           | 30.41                                      |
| Grootfontein ...       | 15.83  | ...    | ...                           | 27.09                                      |
| Induna Farm ...        | 14.43  | ...    | ...                           | 28.58                                      |
| Requeza Estate ...     | 14.09  | ...    | ...                           | n.s.                                       |
| Gutu—                  |        |        |                               |                                            |
| Gutu ...               | 12.75  | ...    | ...                           | 29.75                                      |
| Glenary ...            | 8.69   | 0.05   | 29.63                         | n.s.                                       |
| M'vimvi Ranch ...      | 14.92  | ...    | ...                           | 28.15                                      |
| Tel-el-Kebir ...       | 21.42  | 0.14   | 48.03                         | 29.24                                      |
| Gwelo—                 |        |        |                               |                                            |
| Lover's Walk ...       | 11.42  | ...    | ...                           | 24.86                                      |
| Oaklands ...           | 12.11  | ...    | ...                           | 30.21                                      |
| Partridge Farm ...     | 15.66  | ...    | ...                           | 29.50                                      |
| Sheep Run Farm ...     | 17.68  | ...    | ...                           | 29.40                                      |
| Insiza—                |        |        |                               |                                            |
| Roodeheuvcl ...        | 11.05  | ...    | ...                           | n.s.                                       |
| Inyanga—               |        |        |                               |                                            |
| St. Trias' Hill ...    | 13.22  | 0.52   | 47.02                         | 39.35                                      |
| Makoni—                |        |        |                               |                                            |
| Chitora ...            | 14.24  | 1.39   | 48.04                         | 35.00                                      |
| Craigendoran ...       | 14.05  | ...    | ...                           | 30.61                                      |
| Gorubi Springs ...     | 18.47  | 0.30   | 42.13                         | 37.41                                      |
| Mona ...               | 16.25  | 1.34   | 43.07                         | 34.71                                      |
| Monte Cassino ...      | 16.57  | ...    | ...                           | 34.60                                      |
| Rusape ...             | ...    | ...    | ...                           | 31.85                                      |
| Springs ...            | 13.82  | ...    | ...                           | 36.82                                      |
| Marandellas—           |        |        |                               |                                            |
| Bonongwe ...           | 10.37  | 1.00   | 42.47                         | 30.43                                      |
| Delta ...              | 13.60  | 0.66   | 42.76                         | 35.73                                      |



## RAINFALL—(Continued).

| STATION.                    | 1923.  |        | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|-----------------------------|--------|--------|-------------------------------|--------------------------------------------|
|                             | March. | April. |                               |                                            |
| Zone E.—(Continued)         |        |        |                               |                                            |
| Marandellas (Continued)—    |        |        |                               |                                            |
| Igudu ...                   | 10.43  | 0.50   | 36.35                         | n.s.                                       |
| Land Settlement ...         | 17.24  | 0.46   | 45.05                         | 32.50                                      |
| Lendy Estates ...           | 12.53  | 1.33   | 44.87                         | 33.90                                      |
| Marandellas ...             | 16.83  | 1.24   | 57.77                         | 36.06                                      |
| Nelson ...                  | 9.75   | ...    | ...                           | 30.38                                      |
| Tweedjan ...                | 14.74  | 0.53   | 40.03                         | 35.58                                      |
| White Gambolo Ranch ...     | 10.64  | 1.30   | 43.15                         | n.s.                                       |
| Melsetter—                  |        |        |                               |                                            |
| Brackenbury ...             | 22.93  | 2.00   | 63.86                         | 50.42                                      |
| Tom's Hope ...              | 19.89  | 1.23   | 65.75                         | 46.00                                      |
| Ndanga—                     |        |        |                               |                                            |
| Doornfontein ...            | 11.95  | 0.23   | 41.73                         | 34.30                                      |
| Ndanga... ..                | 16.96  | ...    | ...                           | 41.60                                      |
| Triangle Ranch ...          | ...    | ...    | ...                           | n.s.                                       |
| Selukwe—                    |        |        |                               |                                            |
| Aberfoyle Ranch ...         | 14.02  | 0.36   | 46.53                         | 31.04                                      |
| Hillingdon ...              | 16.99  | ...    | ...                           | 30.90                                      |
| Impali Source ...           | 14.47  | ...    | ...                           | n.s.                                       |
| Rio ...                     | 12.99  | ...    | ...                           | 28.34                                      |
| Umtali—                     |        |        |                               |                                            |
| Argyll ...                  | 13.03  | 1.14   | 41.55                         | ...                                        |
| Gilmerton ...               | 15.66  | ...    | ...                           | 30.81                                      |
| Jerain ...                  | 17.31  | ...    | ...                           | 32.23                                      |
| Mutambara Mission ...       | 12.85  | 1.30   | 42.07                         | 28.82                                      |
| Odzani Power Station ...    | 20.22  | 0.96   | 51.44                         | 35.08                                      |
| Park Farm ...               | 24.69  | ...    | ...                           | n.s.                                       |
| Premier Estate ...          | 14.08  | 0.62   | 45.27                         | 29.30                                      |
| Sarum ...                   | 17.13  | ...    | ...                           | 32.50                                      |
| Stapleford ...              | 25.25  | 4.48   | 85.29                         | 63.10                                      |
| St. Augustine's Mission ... | 17.72  | 0.85   | 53.86                         | n.s.                                       |
| Umtali (Gaol) ...           | 16.65  | 0.83   | 52.45                         | 31.13                                      |
| Victoria—                   |        |        |                               |                                            |
| Brucehame ...               | 9.68   | 0.28   | 35.55                         | ...                                        |
| Cambria ...                 | 8.28   | 0.33   | 31.81                         | n.s.                                       |
| Chevenden ...               | 13.10  | 0.65   | 45.69                         | n.s.                                       |
| Clipsham ...                | 6.95   | 0.38   | 33.39                         | 28.63                                      |
| Glenlivet ...               | 16.20  | ...    | ...                           | n.s.                                       |
| Gokomere ...                | 12.78  | 0.24   | 43.41                         | 25.55                                      |
| Histonhurst ...             | 8.55   | ...    | ...                           | n.s.                                       |
| Makahori Farm ...           | 11.12  | —      | 38.14                         | n.s.                                       |
| Makorsi River Ranch ...     | 17.85  | —      | 46.11                         | 32.89                                      |
| Mashaba ...                 | 9.48   | ...    | ...                           | n.s.                                       |
| Morgenster Mission ...      | 19.46  | 1.69   | 62.05                         | 39.93                                      |
| M'Sali ...                  | 9.09   | 0.06   | 29.10                         | n.s.                                       |
| Riverdene North ...         | 11.16  | 0.24   | 39.65                         | 30.66                                      |
| Salemore ...                | 11.01  | ...    | ...                           | n.s.                                       |
| Silver Oaks ...             | 8.79   | 0.20   | 30.87                         | 28.31                                      |

## RAINFALL—(Continued).

| STATION.              | 1923.  |        | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |       |       |
|-----------------------|--------|--------|-------------------------------|--------------------------------------------|-------|-------|
|                       | March. | April. |                               |                                            |       |       |
| ZONE E.—(Continued)   |        |        |                               |                                            |       |       |
| Victoria (Continued)— |        |        |                               |                                            |       |       |
| Stanmore              | ...    | ...    | 13.75                         | —                                          | 42.09 | 27.00 |
| Summerton             | ...    | ...    | 5.72                          | ...                                        | ...   | 26.10 |
| Tewkesbury            | ...    | ...    | 11.29                         | ...                                        | ...   | n.s.  |
| Tichidza              | ...    | ...    | 14.95                         | 1.64                                       | 60.38 | 34.80 |
| Victoria              | ...    | ...    | 9.52                          | 0.24                                       | 29.67 | 26.00 |
| Zimbabwe              | ...    | ...    | 12.78                         | ...                                        | ...   | n.s.  |
| ZONE F.:              |        |        |                               |                                            |       |       |
| Melsetter—            |        |        |                               |                                            |       |       |
| Chikore               | ...    | ...    | 18.35                         | 1.18                                       | 60.08 | 46.85 |
| Chipinga              | ...    | ...    | 15.75                         | 1.69                                       | 59.54 | 47.05 |
| Melsetter             | ...    | ...    | 16.06                         | ...                                        | ...   | 43.46 |
| Mount Selinda         | ...    | ...    | 19.72                         | ...                                        | 62.78 | 66.15 |
| Vermont               | ...    | ...    | 24.22                         | ...                                        | ...   | 63.40 |
| Umtali—               |        |        |                               |                                            |       |       |
| Hoboken               | ...    | ...    | 26.41                         | ...                                        | ...   | 56.80 |

— means nil.

... means no return.

# Dates of Meetings of Farmers' Associations, Southern Rhodesia (SUBJECT TO ALTERATION)

| Name of Association                   | Place of Meeting                                 | Secretary          | June | July  | Aug. st |
|---------------------------------------|--------------------------------------------------|--------------------|------|-------|---------|
| Banket Junction ..                    | Banket Hotel                                     | C. S. Larter ..    | 2    | 28    | 4       |
| Beatrice District ..                  | Farmers' Hall, Beatrice                          | W. Krienke ..      | 28   | 26    | 26      |
| Bindura ..                            | Bindura                                          | W. Ashby ..        | 1    | 1     | 11      |
| Bromley ..                            | Bromley                                          | C. J. Shirley ..   | 7    | 5     | 2       |
| Eastern Border (South Melseiter)      | Armidale Farm & Mt. Darwin Store alternately     | C. J. W. Goucher   | No   | fixed | dates   |
| Eastern Districts ..                  | Farmers' Hall, Chitdra                           | J. Rademeyer ..    | 9    | 14    | 11      |
| Enkeldoorn ..                         | Enkeldoorn                                       | Geo. Trully ..     | 9    | 5     | 2       |
| Enterprise ..                         | Arcturus Hotel                                   | G. G. Pickering .. | 7    | 5     | 2       |
| Felixburg—Gutu ..                     | Joe, Gutu, Juby, Grassl's, Felixburg, Aug., Gutu | F. F. Lock ..      | 7    | 14    | 11      |
| Gabali ..                             | Huyani Drift                                     | A. S. Will ..      | 7    | 5     | 2       |
| Gatoona ..                            | Speck's Hotel                                    | A. Kelsey-Harvey   | 16   | fixed | dates   |
| Gazaland ..                           | Chippinga Court House ..                         | James Ward ..      | 12   | 12    | 18      |
| Greystone ..                          | Various farm houses, Shangani                    | M. Kerr ..         | 1    | 1     | 1       |
| Iwanda ..                             | Royal Hotel, Gwanda                              | J. C. Thompson     | 1    | 1     | 1       |
| Isiwa ..                              | Headlands Station                                | J. de L. Nimmo     | 23   | 28    | 25      |
| Headlands ..                          | Headlands Station                                | J. Grevar ..       | 22   | fixed | dates   |
| Hunter's Road Farmers and Stockowners | Hunter's Road Siding                             | R. W. Twilley ..   | No   | 6     | 3       |
| Indiza—Shangani ..                    | Shangani                                         | M. E. Weale ..     | 9    | 14    | 11      |
| Isiza South ..                        | Lancaster                                        | J. Campbell ..     | 13   | 17    | 8       |
| Inyanga ..                            | Rhodes Inyanga Estate                            | E. H. Becking ..   | 13   | 17    | 15      |
| Isiwa ..                              | Lalapani                                         | E. H. Elgin ..     | 18   | 16    | 20      |
| Lalapani ..                           | Sinola                                           | J. F. Piggin ..    | 8    | 3     | 3       |
| Louagundi ..                          | Macheke                                          | F. W. Robertson    | No   | fixed | dates   |
| Macheke ..                            | Makwiro                                          | W. L. McLean ..    | 15   | 20    | 17      |
| Makwiro ..                            | Makwiro                                          | James G. Dickson   | 27   | 25    | 23      |
| Makoni North ..                       | Makoni South Farm                                | J. G. Monckton     | 2    | 1     | 1       |
| Makoni ..                             | Makoni                                           | W. E. J. Henson    | 2    | 1     | 1       |
| Marandellas, Northern                 | Marandellas Farmers' Hall                        | C. N. Elliot ..    | 6    | 11    | 8       |
| Marandellas, Southern                 | Various farms                                    | W. E. J. Henson    | No   | fixed | dates   |
| Mashonaland ..                        | Commercial Hotel, Salisbury                      | L. Noaks ..        | No   | fixed | dates   |
| Matopo Branch, R. L. and P. A.        | Hill Farm                                        | W. S. George ..    | 13   | 11    | 8       |
| Mazoe ..                              | Glendale                                         | M. D. Ward ..      | 1    | 6     | 3       |
| Mazoe Central ..                      | Mazoe Hotel                                      | J. Wills ..        | 1    | 6     | 3       |
| Mazoe ..                              | Mazoe                                            | J. Harrie ..       | 14   | 12    | 9       |
| Melseiter (North) ..                  | Cronley                                          | R. Wodehouse       | 14   | 12    | 9       |
| Midlands Farmers and Stockowners      | Royal Hotel, Gwelo                               | R. P. Gaunt ..     | 19   | 17    | 21      |
| Norton and Lydiat District ..         | Farm Summerfield                                 | A. Tulloch ..      | 1    | 6     | 3       |
| Norton ..                             | Norton Store                                     | W. Wrench ..       | 1    | 6     | 3       |
| Nyanandhiyov ..                       | Nyanandhiyov                                     | E. J. Ross ..      | 1    | No    | dates   |
| Rhodesian Landowners and Farmers      | Library Buildings, Bulawayo                      | H. S. Hopkins ..   | 26   | 26    | 18      |
| Selous ..                             | Various farms                                    | C. C. Douglas      | 16   | 21    | 18      |
| Selukwe ..                            | Selukwe                                          | W. T. Simpson      | 15   | fixed | dates   |
| Shamva ..                             | Shamva                                           | A. Musson ..       | 21   | fixed | dates   |
| Unvukwe ..                            | Various ranches                                  | F. S. Holland ..   | 16   | 16    | 12      |
| Unvukwe ..                            | Dunali, Untali                                   | P. S. Holland ..   | 17   | 15    | 9       |
| Unvukwe ..                            | Victoria                                         | M. W. Graham ..    | 29   | 27    | 31      |
| Victoria ..                           | Victoria                                         | W. F. N. Thornton  | 1    | 6     | 3       |
| Wankie District ..                    | Wankie                                           | W. E. Cumming      | 27   | 27    | 11      |
| Western ..                            | Plumtree Hotel                                   | W. E. Goucher      | 9    | 14    | 11      |

## RHODESIAN MILK RECORDS TO DATE.

| Name of cow. | Breed.    | Commenced record. | Milk in lbs. Latest return. | Butter fat in lbs. Latest return. | Milk in lbs. to date. | Butter fat in lbs. to date. | Time from commencement of record. | Name and address of owner.               |
|--------------|-----------|-------------------|-----------------------------|-----------------------------------|-----------------------|-----------------------------|-----------------------------------|------------------------------------------|
| Banjo ...    | Shorthorn | 9/8/22            | 307.3                       | 14.04                             | 3,802.0               | 152.41                      | 252 days                          | C. G. T. Cooper, Essexvale               |
| Betta ...    | do        | do                | 226.1                       | 10.02                             | 3,339.2               | 139.39                      | 224 do                            | do do                                    |
| Fourbob ...  | do        | 16/8/22           | 265.3                       | 13.19                             | 3,517.5               | 177.70                      | 245 do                            | do do                                    |
| Baby ...     | do        | 4/10/22           | 231.4                       | 11.57                             | 2,645.0               | 122.45                      | 196 do                            | do do                                    |
| Pepper ...   | do        | 1/11/22           | 301.0                       | 12.45                             | 2,383.5               | 112.09                      | 168 do                            | do do                                    |
| Zaza ...     | do        | 8/12/22           | 207.9                       | 12.04                             | 2,308.9               | 124.24                      | 161 do                            | do do                                    |
| Ann ...      | do        | 26/12/22          | 232.1                       | 15.80                             | 1,387.4               | 70.17                       | 105 do                            | do do                                    |
| Mary ...     | do        | 14/3/23           | 489.3                       | 18.64                             | 614.6                 | 23.80                       | 35 do                             | do do                                    |
| Begonia ...  | Friesland | 19/9/22           | 1,328.5                     | 43.84                             | 10,780.6              | 365.21                      | 210 do                            | J. A. Baxter, Victoria Street, Sby.      |
| Aggie ...    | Cape Cow  | 3/9/22            | 335.0                       | 13.48                             | 3,171.0               | 124.57                      | 168 do                            | Knight & Folkestad, Lochinvar, Salisbury |
| Peggy ...    | do        | do                | 420.0                       | 17.64                             | 3,418.0               | 127.57                      | 168 do                            | do do                                    |
| Daisy ...    | Friesland | do                | 486.0                       | 22.86                             | 3,562.0               | 150.54                      | 168 do                            | do do                                    |
| Joan ...     | Shorthorn | do                | 483.0                       | 19.32                             | 3,493.0               | 150.78                      | 168 do                            | do do                                    |
| Henrietta*   | do        | 24/11/22          | 294                         | ...                               | 1,879.5               | ...                         | 140 do                            | R. C. MacLagan, Rusape.                  |
| Spottrie*    | Ayrshire  | do                | 140                         | ...                               | 787.5                 | ...                         | 112 do                            | do do                                    |
| Agnes*       | do        | 1/12/22           | 185.5                       | ...                               | 896.0                 | ...                         | 112 do                            | do do                                    |
| Gladys*      | do        | 2/2/23            | 413.0                       | ...                               | 920.5                 | ...                         | 70 do                             | do do                                    |
| Daisy*       | Friesland | 16/10/22          | 469                         | ...                               | 3,829.0               | ...                         | 182 do                            | F. E. Pickering, Fairview, Sinoia        |
| Cherry*      | do        | 20/11/22          | 480                         | ...                               | 2,901.0               | ...                         | 168 do                            | do do                                    |
| Peach*       | do        | 27/11/22          | 392                         | ...                               | 2,730.0               | ...                         | 119 do                            | do do                                    |
| Bella*       | do        | 24/10/22          | 434                         | ...                               | 3,332.0               | ...                         | 168 do                            | do do                                    |

\* These cows are suckling their calves.

N. B.—A gallon of milk weighs approximately 10 lbs.

## RHODESIAN MILK RECORDS—continued.

| Name of cow.        | Breed.    | Commenced record. | Milk in lbs. Latest return. | Butter fat in lbs. Latest return. | Milk in lbs. to date. | Butter fat in lbs. to date. | Time from commencement of record. | Name and address of owner.          |
|---------------------|-----------|-------------------|-----------------------------|-----------------------------------|-----------------------|-----------------------------|-----------------------------------|-------------------------------------|
| Maureen             | Friesland | 13/8/22           | 413                         | 15.69                             | 5,070                 | 205.21                      | 224 days                          | J. S. Struthers, Palm Tree, Simoia  |
| Rosebud             | do        | 17/9/22           | 329                         | 18.42                             | 3,317                 | 164.56                      | 224 do                            | do                                  |
| Bell                | do        | 8/10/22           | 479                         | 21.56                             | 5,107                 | 216.11                      | 203 do                            | do                                  |
| Cherry Blossom      | do        | 27/11/22          | 532                         | 29.79                             | 3,853                 | 205.49                      | 154 do                            | do                                  |
| Lucy                | do        | 10/12/22          | 451                         | 21.65                             | 3,242                 | 139.67                      | 140 do                            | do                                  |
| Moffie              | do        | 17/12/22          | 451                         | 19.84                             | 3,096                 | 124.74                      | 133 do                            | do                                  |
| Snowflake           | do        | 31/12/22          | 406                         | 17.86                             | 2,500                 | 100.20                      | 119 do                            | do                                  |
| Palm Tree Peach     | do        | 7/1/23            | 567                         | 24.38                             | 2,939                 | 117.47                      | 112 do                            | do                                  |
| Palm Tree Lady      | do        | do                | 504                         | 20.16                             | 2,289                 | 95.38                       | 112 do                            | do                                  |
| Corral              | do        | 4/3/23            | 963                         | 52.97                             | 2,069                 | 113.80                      | 56 do                             | do                                  |
| Granny              | do        | 25/3/23           | 805                         | 40.25                             | 1,005                 | 50.25                       | 35 do                             | do                                  |
| Zuurfontein Mina I. | do        | 28/11/22          | 664.2                       | ...                               | 3,569.2               | ...                         | 120 do                            | H. H. Smetham, Fairview, Penhalonga |
| Pansy IV.           | do        | 6/5/22            | 322.0                       | ...                               | 7,232.0               | ...                         | 336 do                            | C. F. Anthony, Randolph Farm, Gwelo |
| Ruitge Emma         | do        | 26/8/22           | 452.0                       | ...                               | 5,105.0               | ...                         | 252 do                            | do                                  |

## Departmental Notices.

The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

### **BOTANICAL SPECIMENS FOR IDENTIFICATION.**

In all cases where a botanical identification is required it is of the utmost importance that the specimens reach the Department of Agriculture in a thoroughly dry condition, free from mildew, and intact, that is not broken in pieces. Whenever possible specimens should comprise main stem or small branch, leaves, flowers, seed vessels and roots or bulbs, though these need not necessarily be on the same plant.

The colour of the flowers and the general form of the plant should be preserved by pressing and drying between two sheets of blotting paper or newspaper. Ordinary plants not excessively succulent can be dried sufficiently in three days, provided the drying papers are changed every day. A heavy weight should be placed on the specimens in order to press them flat.

Correspondents are asked to supply the following particulars as far as possible:—

- (a) height and general appearance of plant or tree;
- (b) class of soil on which found;
- (c) locality and altitude;
- (d) supposed use or properties.

It is advised that specimens be packed between two sheets of cardboard or thin wood, since in this way they will travel long distances without fear of injury.

## Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

### AGRICULTURE AND CROPS.

- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 218. Useful Measurements for Maize, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 257. Maize Grading, by J. A. T. Walters, B.A.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 327. Linseed, by C. Mainwaring.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Virgin Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- No. 394. The Interdependence of Crop Rotation and Mixed Farming, by H. G. Mundy, F.L.S.
- No. 397. The Advantage of Autumn and Early Winter Ploughing, by C. Mainwaring.
- No. 399. Green Manuring and Soil Management, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 403. Florida Beggar Weed, by H. G. Mundy, F.L.S.
- No. 407. Wheat—Extracts from Bulletin No. 22, Victoria, Australia.

- No. 408. The Velvet Bean, by J. A. T. Walters, B.A.  
 No. 416. Grasses of Agricultural Importance in Southern Rhodesia, by H. G. Mundy, F.L.S., G. N. Blackshaw, O.B.E., B.Sc., F.I.C., and E. V. Flack.  
 No. 417. The Ground Nut or Monkey Nut, by C. Mainwaring.  
 No. 422. Improvement of Rhodesian White Maize by Selection, by C. Mainwaring.  
 No. 423. The Common Sunflower, by C. Mainwaring.  
 No. 428. The Sweet Potato, by J. A. T. Walters, B.A.  
 No. 429. Propagation of Kudzu Vine, by H. C. Arnold.  
 No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.  
 No. 445. Production of Maize, by C. Mainwaring.  
 No. 454. The Growing of Potatoes in Southern Rhodesia, by C. Mainwaring.  
 No. 455. White v. Yellow Maize, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.  
 No. 456. Legumes in Southern Rhodesia, by J. A. T. Walters.  
 Botanical Specimens for Identification.

#### REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.  
 No. 189. The Manuring of Maize on the Government Experiment Farm, Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.  
 No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.  
 No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.  
 No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.  
 No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.  
 No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.  
 No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.  
 No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.  
 No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.  
 No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.  
 No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.  
 No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.  
 No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.  
 No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-1920.  
 No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.  
 No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.  
 No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.  
 No. 432. Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S.  
 No. 433. Winter Cereal Experiments, 1921, by D. E. McLoughlin.  
 No. 437. Annual Report on Crop Experiments, Gwebi, 1921-22, by H. G. Mundy, F.L.S.  
 No. 440. Annual Report of Experiments, 1921-22, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.



## TOBACCO.

- No. 346. Tobacco Culture—Grading on the Farm, by H. W. Taylor, B.Agr.
- No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.
- No. 398. Wildfire and Angular Spot.
- No. 404. Flue-Curing Tobacco Barns and Packing House (Second Revision),  
by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.
- No. 410. Common Mistakes in Growing and Handling Virginia Tobacco,  
by H. W. Taylor, B.Agr.
- No. 444. Tobacco Seed Beds, by H. W. Taylor, B.Agr.  
Handbook of Tobacco Culture for Planters in Southern Rhodesia,  
price 2s. 6d., post free outside South Africa 3s. 6d.

## STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by  
Eric A. Nobbs, Ph.D., B.Sc.
- No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.
- No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season  
1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood.
- No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D.,  
B.Sc., and B. Haslewood, F.S.S.
- No. 247. Statistical Returns of Crops grown by Europeans in Southern  
Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D.,  
B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S.,  
Statistician.
- No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A.  
Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.
- No. 286. Statistics of Live Stock and Animal Produce for the Year 1917,  
by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and  
F. Eyles, F.L.S.
- No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles,  
F.L.S.
- No. 361. Statistics of Live Stock and Animal Produce for the Year 1919,  
by F. Eyles, F.L.S.
- No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia,  
1919-1920, by H. C. K. Fynn.
- No. 393. Statistics of Live Stock and Animal Produce for 1920, by  
H. C. K. Fynn.
- No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia  
for the season 1920-21, by H. C. K. Fynn.
- No. 426. Statistics of Live Stock and Animal Products for the year 1921,  
by H. C. K. Fynn.
- No. 443. Statistics of Crops Grown by Europeans in Southern Rhodesia  
for the Season 1921-22, by F. Eyles, F.L.S., and H. C. K.  
Fynn.

## LIVE STOCK.

- No. 145. Prospects of Importation of Cattle from Australia, by E. A.  
Nobbs, Ph.D., B.Sc.
- No. 208. Water in the Diet of Live Stock, by Ll. E. W. Bevan, M.R.C.V.S.
- No. 210. The Care and Feeding of Calves in Dairy and Stud Herds, by  
R. C. Simmons.
- No. 227. An Experiment in Beef Production, by R. C. Simmons.
- No. 245. Beef Feeding Experiment No. 2, by R. C. Simmons.
- No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by  
A. G. Holborow, F.I.C., Assistant Government Agricultural  
Chemist.

- No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.  
 No. 255. Pound Fees.  
 No. 287. Sheep Farming for Mutton Purposes on Granite Veld and Mixed Farms, by R. C. Simmons.  
 No. 321. The Construction of Dipping Tanks for Cattle. Revised April, 1919.  
 No. 336. Butchering and Flaying.  
 No. 338. From Breeder to Butcher; Beef Feeding Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.  
 No. 340. Notes on Theory and Practice of Feeding Cattle in Southern Rhodesia, Part III., by R. C. Simmons.  
 No. 345. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part IV., by R. C. Simmons.  
 No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.  
 No. 392. Memorandum on the Cattle Industry of Southern Rhodesia, 1921.  
 No. 421. From Breeder to Butcher: Cattle Feeding Experiment No. 9. Government experiment farm, Gwebi, by E. A. Nobbs, Ph.D., B.Sc., F.H.A.S.  
 No. 446. From Breeder to Butcher: Cattle Feeding Experiment No. 11. Government Experiment Farm, Gwebi, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.  
 No. 448. The Cattle Industry.  
 ————— Arsenite Cattle Dip—How to Mix.

## DAIRYING.

- No. 277. A Farm Cheese and Butter Dairy, by R. C. Simmons and G. U. Frupp.  
 No. 328. Pont l'Eveque Cheese, by J. B. Fisher, N.D.D.  
 No. 329. Gervais Cheese, by J. B. Fisher, N.D.D.  
 No. 356. Cream and its Production, by T. Hamilton.  
 No. 370. Development of Flavour in Butter, by T. Hamilton, M.A., N.D.A., N.D.D.  
 No. 383. Control of Temperature in Dairying, by T. Hamilton, M.A., N.D.A., N.D.D.  
 No. 395. Farm Butter Making, by T. Hamilton, M.A., N.D.D., N.D.A.  
 No. 401. Milk Records and Milk Testing, by T. Hamilton, M.A., N.D.A., N.D.D.  
 No. 418. Manufacture of Cheddar Cheese, by T. Hamilton, M.A., N.D.A., N.D.D.  
 No. 427. Common Defects in Butter-making, by T. Hamilton, M.A., N.D.A., N.D.D.  
 No. 449. Farm Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D.

## VETERINARY.

- No. 51. Strangles, by F. D. Ferguson, M.R.C.V.S.  
 No. 121. Rabies, by L. E. W. Bevan, M.R.C.V.S., and T. G. Millington, M.R.C.V.S., D.V.H.  
 No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.  
 No. 313. Obstruction in Sheath of Ox, by J. M. Sinclair, M.R.C.V.S.  
 No. 316. Inoculation of Cattle against Redwater and Gall-sickness, by L. E. W. Bevan, M.R.C.V.S.  
 No. 352. African Coast Fever, by L. E. W. Bevan, M.R.C.V.S.  
 No. 364. Round-worm Infection of Calves, by H. E. Hornby, M.R.C.V.S.  
 No. 367. Quarter-evil, by C. R. Edmonds, M.R.C.V.S.

- No. 431. History, Control and Treatment of Infectious Abortion in Cattle in Southern Rhodesia, by L. E. W. Bevan, M.R.C.V.S.  
 No. 435. A Short History of Infective Diseases, by J. M. Sinclair, M.R.C.V.S.  
 Services of Government Veterinary Surgeon

## IRRIGATION.

- No. 270. Odzani River Irrigation Scheme, by W. M. Watt.  
 No. 300. The Dangers and Prevention of Soil Erosion, by W. M. Watt.  
 No. 349. The Hydraulic Ram, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.  
 No. 376. Notes on the Water Law of Southern Rhodesia, by R. McIlwaine, M.A., LL.B.  
 No. 384. The Application of Water in Irrigation, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.  
 No. 400. Soil Washing, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.  
 No. 412. Water Power Resources of Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.  
 No. 419. Irrigation Canals, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.  
 No. 452. Weirs and their Construction, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.,  
 Engineering Advice.

## FORESTRY.

- No. 199. Eucalypts for the Farm, by J. J. Boocock.  
 No. 366. The Management of Woods, by J. S. Henkel.  
 No. 386. Forestry in Rhodesia: Improvement Fellings on the Farm, by J. S. Henkel.  
 No. 439. Forestry in Rhodesia: Planting and Care of Forest Trees, by J. S. Henkel.  
 No. 457. The Planting and Care of Hedges, by J. S. Henkel.  
 Price List of Forest Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds.

## HORTICULTURE.

- No. 75. Fumigation of Fruit Trees with Hydrocyanic Acid Gas, by R. W. Jack, F.E.S.  
 No. 354. The Home Orchard, by A. G. Turner.  
 No. 424. Citrus Fruit Growing in Rhodesia, by A. G. Turner.

## ENTOMOLOGY AND VEGETABLE PATHOLOGY.

- No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.  
 No. 171. The Cabbage Web-Worm—A Pest of Cabbage and Allied Plants, by R. W. Jack, F.E.S.  
 No. 172. Diseases of the Potato Tuber and the Selection of Sound Seed, by R. W. Jack, F.E.S.  
 No. 178. Illustrations of Natural Forest in relation to Taetse Fly, by R. W. Jack, F.E.S.  
 No. 187. The Dusty Surface Beetle, by Rupert W. Jack, F.E.S.  
 No. 197. Chafer Beetles, by R. W. Jack, F.E.S.  
 No. 204. Some Injurious Caterpillars, by R. W. Jack, F.E.S.  
 No. 214. Some Household Insects, by R. Lowe Thompson, B.A.  
 No. 219. More Household Insects, by R. Lowe Thompson, B.A.  
 No. 228. Rhodesian Citrus Pests, by R. W. Jack, F.E.S.  
 No. 233. Does it Pay to Spray Potatoes in Southern Rhodesia? by Rupert W. Jack, F.E.S.

- No. 249. Home-made Fly Papers, by Rupert W. Jack, F.E.S., Government Entomologist.
- No. 261. Turnip Sawfly, by R. W. Jack, F.E.S.
- No. 276. The Maize Stalk Borer, by Rupert W. Jack, F.E.S.
- No. 280. The Maize Beetle, by R. W. Jack, F.E.S.
- No. 290. Notes on Remedies for Turnip Sawfly, by Rupert W. Jack, F.E.S.
- No. 291. Cutworms, by Rupert W. Jack, F.E.S.
- No. 302. A Note on the Maize Stalk Borer, by Rupert W. Jack, F.E.S.
- No. 317. Maize Culture on Red Soil; Value of Poisoned Bait as an Aid to Good Stands, by Rupert W. Jack, F.E.S.
- No. 353. Further Experiments with Poisoned Bait on Maize Lands, by R. W. Jack, F.E.S.
- No. 369. The Bean Stem Weevil, by R. W. Jack, F.E.S.
- No. 385. The Common Fruit Beetle, by R. W. Jack, F.E.S.
- No. 402. Ticks Infesting Domestic Animals in Southern Rhodesia, by R. W. Jack, F.E.S.
- No. 425. A Newly Recorded Pest of Maize: "Rootworm," by R. W. Jack, F.E.S.
- No. 450. Insect Pests of Fruits other than Citrus in Southern Rhodesia, by R. W. Jack, F.E.S.

#### POULTRY.

- No. 377. The Fowl Tick, by A. Little.
- No. 406. The Turkey, by A. Little.
- No. 415. Mating for Improvement and Increased Egg Production, by A. Little.
- No. 420. Poultry Husbandry: Housing and Feeding of Adult Fowls, by A. Little.
- No. 434. Some Common Diseases of Poultry, by A. Little.
- No. 441. Some Common Diseases of Poultry, by A. Little.
- No. 451. Breeding for Increased Egg Production, by H. G. Wheeldon.
- No. 458. Artificial Incubation, Brooding and Rearing of Chickens, by H. G. Wheeldon.

#### METEOROLOGICAL.

- No. 436. The Possibility of Seasonal Forecasting and Prospects for Rain-fall Season 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.

#### MISCELLANEOUS.

- No. 93. Formation of Agricultural Credit Associations in Rhodesia, by Loudon M. Douglas, F.R.S.E.
- No. 226. Classification of Clouds, by R. H. Scott, F.R.S.
- No. 254. Hints on Explosives, by W. M. Watt.
- No. 264. Nature Notes—Adaptation, by C. F. M. Swynnerton, F.L.S.
- No. 273. Enkeldoorn Produce Express Syndicate Rules.
- No. 274. Lecture on Malaria and Blackwater, by A. M. Fleming, C.M.G., M.B., C.M., F.R.C.S.E., D.P.H., Medical Director.
- No. 283. Maize Foods for the Home.
- No. 294. Directions for taking Samples for Analysis, by E. V. Flack, Acting Agricultural Chemist.
- No. 318. Notes on Mining Law for Farmers, by Advocate D. E. McCausland, M.A., LL.B.
- No. 358. Notes on the Regulations governing the Sale of Fertilisers and Farm Foods, by E. V. Flack.
- No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.

- No. 391. Hints on Brickmaking, by G. T. Dyke.
- No. 414. Limestones in Southern Rhodesia, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 447. Composition and Fertilising Value of Wood Ash and other Ashes, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 453. The Manufacture of Roofing Tiles on the Farm, by Arthur J. Orner.
- Malarial Fever : How it is caused and how it may be prevented, by Sir Ronald Ross, F.R.C.S., D.Sc., LL.D., F.R.S., K.C.B., etc.
- The Analyses of Agricultural Products, Soils, Water. etc.
- Lectures for Farmers.
- Farming Returns for Income Tax Purposes.
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## Bacon Pigs at Salisbury Show.

The Agricultural Society has been able, through the generosity of some interested members, to increase very considerably the prizes for slaughter pigs at the forthcoming Salisbury Show on 14th, 15th and 16th August.

The classes will be: Five bacon pigs, not over 12 months, weight between 150 lbs. and 200 lbs. each live weight, and three porkers, weight between 60 lbs. and 120 lbs. each live weight. In all £25 will be divided in prizes in these two classes, £15 of which will go to the champion five bacon pigs.

The society gives this early notice so that intending exhibitors will have ample time to prepare their pigs, and as these animals are primarily intended for immediate slaughter, the pig committee has decided that these two classes will be compulsory selling classes, the pigs to be sold by auction. The committee, however, will safeguard sellers by placing an upset price on each pen of pigs.

A very considerable number of entries has already been promised, and a record competition is confidently anticipated.

## Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 126 of 1923.]

[23rd March, 1923.

### "ANIMALS DISEASES CONSOLIDATION ORDINANCE, 1904."

HIS Honour the Acting Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 553 of 1922, and, in terms of section 17 of Government Notice No. 21 of 1917, declare the following areas of infection and guard areas in lieu thereof:—

#### NATIVE DISTRICT OF MELSETTER.

##### (a) *Areas of Infection.*

1. The farms Merino, Smaldeel, Sable Home, Hermit, Umzelezwe, Bamboo Creek, Elandsberg and Umsasa.
2. Randfontein, Nooitgedacht and Avonduur.

##### (b) *Guard Areas.*

1. That portion of the native district of Melsetter lying south of and including the farms Grampians, Umzila, Grass Flats, Daisy Hill, Gelnk, Chikora Annex, Chikora, and the Musikiwani Reserve.
2. An area bounded by and including the Ngorima Reserve, the farms Uitkyk, that portion of Voorspoed south of the Lusitu River, Sterkstroom, Clearwater, Wedge Hill, Newcastle, Landsdown, Heilrand, Canterbury, Woodstock, Enhoek, Ravenswood, Wolfserag, Helvetia and the Portuguese boundary.

No. 127 of 1923.]

[23rd March, 1923.

### AFRICAN COAST FEVER: COMPULSORY DIPPING OF CATTLE.

HIS Honour the Acting Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to declare that, within the areas defined below, on and after the date of publication hereof, every owner of cattle shall cause the same to be dipped in a dipping tank so constructed as to permit of total immersion of cattle at such intervals and in such solutions as the Controller of Stock shall direct.

#### *Description of Areas.*

##### MELSETTER NATIVE DISTRICT.

1. That portion of the native district of Melsetter lying south of and including the farms Grampians, Annex, Chikora and the Musikiwani Reserve.

2. An area bounded by and including the Ngorima Reserve, the farms Uitkyk, that portion of Voorspoed south of the Lusitu River, Sterkstroom, Clearwater, Wedge Hill, Newcastle, Landsdown, Heilrand, Canterbury, Woodstock, Enhoek, Ravenswood, Wolfscrag, Helvetia and the Portuguese boundary.

No. 207 of 1923.]

[18th May, 1923.

**"ANIMALS DISEASES CONSOLIDATION ORDINANCE, 1904."**

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to declare the area described in the schedule annexed hereto to be infected with anthrax.

*Description of Area.*

An area around the Native Commissioner's office at Mtoko enclosed by approximately three miles of fencing.

No. 165 of 1923.]

[20th April, 1923.

**BRANCH ROAD FROM WATERSHED ROAD TO FARM HEDON.**

IT is hereby notified that His Honour the Acting Administrator has been pleased, under the provisions of section 2 of "The Road Regulations, 1896," to declare the following road to be a branch road, *i.e.*, the road leading from the Marandellas-Bristol district road, known as the Watershed road and declared under Government Notice No. 106 of 1913, at a point near to the north-east beacon of the farm Stow, and running thence westerly within Stow and close to its northern boundary to a point near to the homestead on this farm, and thence running through the farm Hedon to a point on its western boundary.

No. 190 of 1923.]

[4th May, 1923.

**BRANCH ROAD FROM LOWER GWELO ROAD TO HUNTER'S ROAD SIDING.**

IT is hereby notified that His Honour the Acting Administrator has been pleased, under the provisions of section 2 of "The Road Regulations, 1896," to declare the undermentioned road to be a branch road, *i.e.*, that road leading from the Lower Gwelo Road at a point known as the Nine Mile Water and running thence northerly over Lancashire, Yorkshire across its western corner, Cumberland, Northumberland, Riverdale, Game Park and Deanfield, and thence in an easterly direction over Foxton, Northfield and Clear Water to a point on the Gwelo-Que Que Main Road near Hunter's Road Station.

No. 199 of 1923.]

[11th May, 1923.

**BRANCH ROAD, LONG CLIFF-GWELLO-UMVUMA MAIN ROAD.**

IT is hereby notified that His Honour the Administrator has been pleased, under the provisions of section 2 of "The Road Regulations, 1896," to declare the following road to be a branch road, *i.e.*, from the homestead on farm No. 75, Umsungwe Block, called Long Cliff, running thence in a south-easterly direction over the said farm and across, and near to the homestead on, farm No. 76, called Sunnyside, across No. 73 and over a portion of No. 69, to join the Gwelo-Umvuma road thereon at a point near the north-east foot of the range of hills.

Nos 147, 159, 174 and 212.]

*Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended from time to time.*

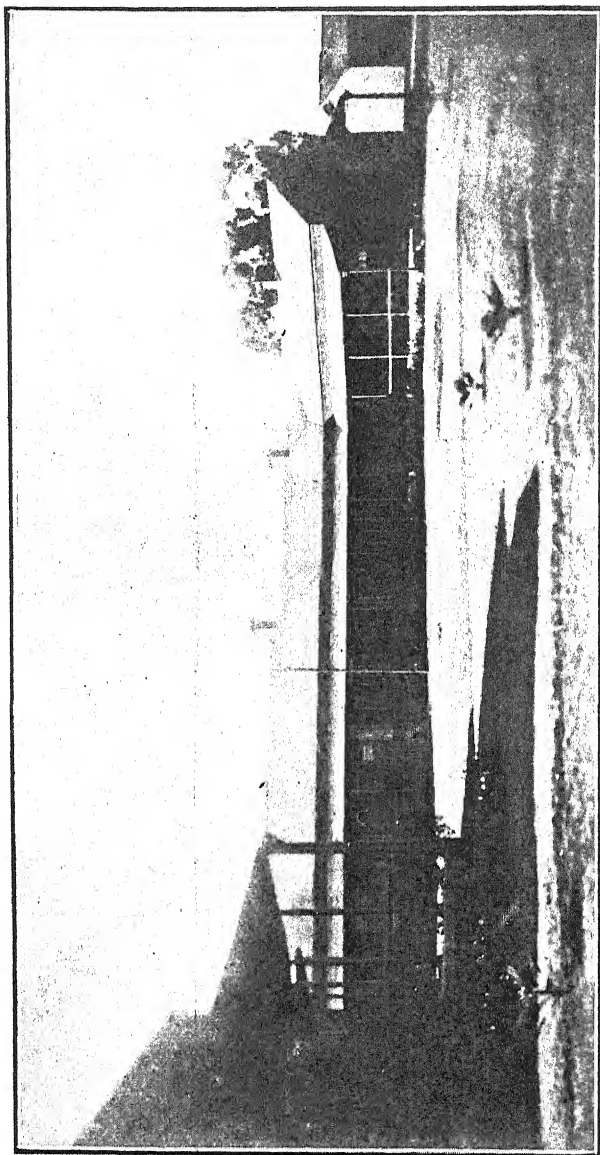
IT is hereby notified that the following applications have been made for authority to use water :—

| Name of applicant.  | Farm                            | Native district of | From what river.                               | Nature of application.                                  | Purpose for which required. | Period for objection      |
|---------------------|---------------------------------|--------------------|------------------------------------------------|---------------------------------------------------------|-----------------------------|---------------------------|
| G. M. Huggins ...   | Lot 53 of Mt. Pleasant          | Salisbury          | Unnamed stream rising on farm Mt. Pleasant do. | To divert public water                                  | To irrigate 15 acres        | Three months from 6-4-23  |
| J. Dennis & Company | Lot 61 of Mt. Pleasant          | do.                |                                                | do.                                                     | To irrigate 50 acres        | do.                       |
| M. Burn ...         | Christmas Pass Hatcliffe Estate | Umtali             | Christmas Pass Spruit Thinyika                 | do.                                                     | To irrigate 6 acres         | Three months from 13-4-23 |
| Mrs. G. Clayton ... |                                 | Salisbury          |                                                | To divert public water and store and divert storm water | To irrigate 30 acres        | Two months from 27-4-23   |
| J. Norris ...       | Devonshire                      | Umtali             | Brewery Spruit                                 | To divert public water                                  | To irrigate 25 acres        | One month from 18-5-23    |
| do. ...             | do.                             | do.                | Sakubva                                        | do.                                                     | do. 5 acres                 | do.                       |

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 539 of 1922, to lodge, within the period above specified from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections or other representations (if any) to the granting of these applications, together with a full statement of the grounds for such objections or representations







Department of Agriculture, Salisbury.



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AUGUST, 1923.

[No. 4.

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## Editorial.

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*Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.*

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**The Department of Agriculture.**—On the opposite page we reproduce a photograph of the offices of the Department of Agriculture, Salisbury. In this building, of which the photograph shows only the front portion, are housed all the administrative and technical officials of the Department, with the exception of the chemistry and entomological sections, which are located at the laboratory adjoining the experiment station to the north of the town.

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**Maize for Export.**—Certain modifications and improvements have been adopted this season in the procedure hitherto followed in regard to maize exported from Southern Rhodesia oversea. To meet the views

of the corn exchanges and overcome certain technical difficulties in future certificates as to quality will be issued at Beira by a representative of the Rhodesian Government specially appointed for the purpose at the port. All maize exported will be subject to examination at Beira and fresh certificates issued indicating the precise quantity and quality at time of shipment. These export certificates will be handed to consignors for attachment to shipping documents. No charge will be made for this service. All maize for export overseas will as hitherto be graded before it leaves this Territory, and to suit exporters the grain will when possible be examined immediately prior to despatch. To facilitate handling, maize delivered at stations or sidings may be piled in solid stacks up to ten bags high, instead of in double rows as formerly, but no overlapping or bonding of bags or rows will be allowed, and all mouths of sacks must face the railway line. The grain of different owners must not be mixed. Grain stacked in the manner described can only be graded during removal to trucks. Maize may also be stacked as hitherto in tiers six bags high and in rows two bags deep, allowing three feet between the double rows and with the mouth outwards. Maize so stacked can be graded at any time prior to despatch and graders' certificates issued in respect of it. As heretofore, grading may be conducted on the farm before the maize is despatched to the station or siding, but farm grading is only performed at farms within ten miles by road of the station or siding to which the maize is to be delivered. It is also only applicable in respect of quantities of 2,000 bags and upwards actually waiting transport. Grain which has been graded may be stacked at sidings or stations in any manner convenient.

Maize of one grade only will be loaded into trucks so far as possible. Grading certificates will be issued and payment recovered as in the past.

It is not required that up-country certificates should accompany the consignments when despatched by rail to Beira.

The grade marks hitherto in force will be modified by the omission of the letters R F W in order to facilitate the work of marking during loading into trucks.

The grades 1, 2 and 3, as defined in the past, are continued and are uniform with the standards adopted in the Union of South Africa.

No maize not graded or below grade may be exported from Southern Rhodesia.

The following are the amended regulations prescribing the grades and grade marks for maize:—

1. The standard grades for Rhodesian white flat maize shall be as follows:—

- (a) Grade 1 shall be sound, dry, plump and well cleaned, with a maximum of altogether 1 per cent. of yellow, discoloured or defective grain.
- (b) Grade 2 shall be sound, dry, plump and reasonably cleaned, and shall not contain more than 3 per cent. of defective and 5 per cent. of other coloured grain.

(c) Grade 3 shall be sound, dry and reasonably cleaned, and shall not contain more than 8 per cent. of defective grain and 5 per cent. of other coloured grain. Grain may be of irregular size and shape.

2. All maize graded and passed for export shall have branded upon the bag the numeral 1, 2 or 3 to indicate the actual grade assigned to each bag.

3. A uniform grading fee of  $\frac{1}{2}$ d. per bag shall be charged for all maize or maize meal examined by an inspector, except as provided for in section 9 of the Ordinance.

Bulletin No. 389 issued by the Department of Agriculture, Salisbury, contains useful information in regard to maize intended for export, and may be obtained free of charge upon application.

Unfortunately, owing to the late rains maize is excessively slow in drying this year. A large number of samples have been tested for moisture content, and the average during the first week of July was about 14 per cent., being 2 per cent. above the standard allowed in maize consigned for export oversea.

**The Tobacco Industry.**—At the annual general meeting of the Rhodesia Tobacco Co-operative Society, held in Salisbury on the 7th June, the chairman, Mr. R. G. Garvin, pointed out that during the financial year the Society had handled 3,391,111 pounds of Virginia tobacco, of which 887,771 pounds had been carried forward from the previous year, at a valuation of £24,687 13s. 10d. This tobacco actually sold for £19,124 3s. 5d., which gave a loss of £5,563 10s. 5d. The other charges in connection with the handling of this tobacco were £1,738 2s., so that there was a deficit of £7,301 12s. 5d., which had been met by an appropriation of that amount from capital fund (levy).

The chairman stated that during the year 1,868,938 pounds of tobacco had been graded on the farms, and only 634,357 pounds of leaf had been sent to the warehouse to be graded. He regarded this as satisfactory evidence that farm grading had come to stay. During the year contracts for the sale of tobacco had been made with the Tobacco Development Company and Mr. Pevsner for a period of three years. The prices were somewhat in advance of those in previous contracts. He stated that a deputation had waited on His Honour the Administrator in connection with the establishment of a tobacco experiment farm. The deputation had been sympathetically received, but were told that no funds were available. The chairman deprecated the position and hoped that this important work would be undertaken by the incoming Government.

Mr. Garvin further stated that, in accordance with the instructions given at the previous annual general meeting and re-affirmed at a special general meeting held in October last, no ungraded tobacco was being received at the warehouse.

The balance sheet was adopted after a full discussion.

A resolution in favour of converting the Society into a limited liability company was adopted and a committee of three was appointed to make the necessary arrangements and report to a special general meeting to be convened later for this purpose.

The members of the Board were re-elected *en bloc*.

**The Wheat Duties.**—Mrs. Tawse Jollie, M.L.C., by her motion in the Legislative Council in favour of the re-imposition of the wheat duties, temporarily suspended as a war measure, raised a debate of much greater magnitude than might have been anticipated, involving a discussion of the first principles of political economy, of free trade and protection, fiscal ideals and the constitution itself. Actually the chief interest of those farmers who are dependent upon wheat as their chief marketable product was the problem at issue. A full dress debate ensued which has been reported at length in the daily Press. Fortunately for the wheat farmers, though the elected members were equally divided when the vote was taken, the Government supported the proposal, which was thus carried by twelve votes to six. The suspension of the duty has accordingly terminated, and the country has reverted to the position as it existed prior to the war. There are in Rhodesia no customs dues on wheat equivalent to the anti-dumping tax in force in the Union.

Though too late to affect this season's crop now growing, it is hoped that farmers will make preparations for materially increasing next season the acreage under wheat in the reasonable hope of securing a fair return for their labour and enterprise.

**Botanist and Mycologist.**—Mr. Fred Eyles, F.L.S., has recently assumed the duties of botanist and plant pathologist in the Department of Agriculture. He has long been known in Rhodesia as an enthusiastic collector of plants, and his private collection, like his knowledge of the flora of the country, is unexcelled.

During the past few months he has been devoting his attention to the most recent advances of mycology—the study of the fungoid diseases of plants—with a view to helping the farmers of Rhodesia to deal with attacks of this nature on their crops and to protect them from the introduction of such plagues from abroad.

The need for an expert in these matters has long been felt, and it is only necessary to remind readers of wildfire and angular spot in tobacco, rust in wheat, scab and blight in potatoes, canker in oranges, mildew and witchweed in maize, smut, bunt, anthracnose and many other plant diseases to convince them what a wide sphere there is for research with a view to diminishing our annual losses from such diseases. The study of the properties of our indigenous flora and the utilisation of our natural vegetation also afford unlimited scope for the work of the botanist.

**A Simple Stump-Puller.**—Considerable interest was manifested at the recent Sinoia Show in a simple stump-pulling contrivance in actual operation. This contrivance was constructed by Mr. Arnold, of Kapiri, from a plan originally taken from the journal *Everyday Science*. In appearance it resembles a gigantic wooden mallet, the head or drum of which is a block of solid round timber about 18 to 20 inches in diameter and 2 feet 6 inches long. What would be the handle of the mallet is a post 9 feet long and 6 inches in thickness passing right through the head and serving as a lever. At the end of the lever an iron pin serves for attaching the end of a trek-tow, to which are inspanned eight oxen. The procedure is that the heavy round block is placed sideways at the base of the tree to be uprooted, the long lever being in a vertical position close and parallel to the trunk of the tree, and a length of trek chain is bound round both tree and lever immediately above the round block. The span of oxen is then driven steadily forward, which brings the lever down from a vertical to a horizontal position, in doing which it turns the block round and lifts the tree, first vertically and then at an angle, until finally it is hauled away by the oxen with apparently but little effort. Mr. Arnold kindly gave the demonstration of the working of this very simple instrument to a number of interested spectators at the Sinoia Show. It effected its purpose extraordinarily well, considering that the ground was very dry and hard, and there was no doubt left in the onlookers' minds that during the wet season trees of 8 or 10 inches in diameter and up to probably 20 feet or more in height could be readily removed by this means, leaving only the very largest ones to be dug out in the usual manner. and the Msassa, which, on account of its enormous and deep roots, has so far refused to give way even to this powerful instrument. It will be noted that there is nothing costly in the making or purchase of this device, which deserves to be very widely known amongst all farmers who have any clearing of their land to do.

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**Crop Returns.**—The attention of our farmers and agriculturists is directed to Government Notice No. 191 of 1923, under which are published the regulations governing the returns required under the Statistical Ordinance of 1914. The return of summer crops is due on 15th September and should reach the Statistician by the 30th of that month. The co-operation of all farmers is requested in order that the final figures may be available for publication at as early a date as possible. These are often considerably delayed owing to a small section of the farming community neglecting to comply with the Ordinance. To enable the statistics compiled to represent an accurate record of the crops reaped, every care should be exercised in filling in the details required. Forms will be forwarded to all known farmers, but if no form is received before the prescribed date, application for one should be made to the Statistician. It should be noted that the onus is on the farmer, and failure to render the summer crop return by 30th September renders him liable to the penalties prescribed under the Ordinance. Non-receipt of forms cannot be pleaded as an excuse for non-compliance with the law.

**Milk Records.**—In our last issue we published the interesting fact that the Friesland cow "Begonia" had produced over 1,000 gallons of milk in 210 days. In the present issue is published the first monthly return of the Friesland cow "Brakfontein Klaske II.," belonging to Messrs. Knight & Folkestad, Lochinvar, Salisbury. As will be seen, this cow has produced no less than 1,652 lbs. of milk in 28 days, an average of almost 6 gallons of milk per day. Klaske II. improved in yield during the month, and on some days produced as much as 8 gallons per day. This bears out our contention that the right cow with the right feed will, under Rhodesian conditions, prove to be as heavy a producer of milk in Rhodesia as in any other part of the world. In the meantime, however, a cow which produces 500 gallons or over in a lactation can be considered an animal well worth having; and if reference is made to the table showing the returns of the various cows in the milk records, it will be seen that every one of the three cows marked as having completed their lactation has exceeded this figure. If by keeping records and by the better care of the milk cows in this Territory the average milk production could be raised to a minimum of 200 gallons per cow, we could at once double our output of dairy products and become exporters of dairy produce on a large scale.

**Molasses Grass and Poultry.**—In view of statements published in the Press about a year ago regarding the extraordinary properties of molasses grass for the discouragement of insects, experiments have been conducted by the poultry expert both with dry hay made from molasses grass and with the grass in fresh condition to ascertain its efficacy on insects infesting poultry. No definite effects have been observed, and it does not appear that the grass possesses the insecticidal properties claimed for it.

**Nitrate of Soda.**—Farmers and others who use nitrate of soda for agricultural purposes are advised to keep their supplies in a safe place, as it has been found that natives use this compound for making explosives. The nitrate is mixed with charcoal made from a plant called "Chipindura," and the mixture on becoming dry is rubbed into a powder. The foregoing was elicited as a result of enquiries made into the disappearance of a bag of nitrate of soda from one of the British South Africa Company's estates.

**The Rusape Show.**—A successful show was held at Rusape on the 22nd June. The new ground, although situated a little further from the railway station, is admirably suited for the purpose, and having security of tenure the Society will be able to proceed with the erection of the structures necessary for the display of exhibits. The classes as a rule were fairly well filled, and the quality was good.



Maize was a particularly strong section, especially the breeding ears, which were well grown and carefully selected. The produce did not show a marked improvement over the exhibits of last year, but competition, especially in the potato classes, was keen. One or two competitors, for the best bag of seed potatoes were disqualified for having their exhibits slightly infested with tuber moth. Some nice samples of haricot beans were staged, as well as of buckwheat, linseed, sweet potatoes and pumpkins. The only entry of teff grass was rejected for containing seeds of noxious weeds. Fruit and flowers were rather weak classes, but of course the season was late for these exhibits.

The cattle entries were limited in numbers, the strongest class being the North Devons, which were represented mainly by cattle from Rhodes Inyanga Estate.

The poultry section was comparatively weak. There are many breeders of good poultry in this district, and it is to be regretted that they refrained from exhibiting their birds. Of the birds staged, Buff Orpingtons led the way in numbers, and they attracted much attention. They were a creditable lot and were exhibited in good condition. The egg exhibits were good and fairly numerous.

The Agricultural Society is deserving of all praise for holding a show in what are undoubtedly difficult times, and we feel sure that the enterprise shown will meet its due reward.

**The Umtali Show.**—The Umtali show is ever a great event with the farmers of the eastern border, and this year's show, held on the 29th and 30th June, was no exception to the rule. The show will rank as one of the most successful held under the auspices of the Umtali and Eastern Districts Agricultural Society, the members of which are to be congratulated upon the results of their efforts. The charming situation of the show ground makes a special appeal to the visitors to Umtali, and provides an admirable setting for an event of this nature. The show afforded His Honour the Administrator, who is shortly relinquishing office, an opportunity of bidding farewell to the farmers of this portion of the Territory, and mutual expressions of goodwill were exchanged in the speeches made at the various ceremonies. A number of notable visitors were present from Mozambique Territory, whose presence testified to the amicable relations existing between the two administrations. The maize exhibits were a feature of the show, and it is pleasing to note that the exhibitors included some young and promising farmers who intend to make their presence felt at future shows. The winning maize exhibits are being sent to the Salisbury Show, where they will add materially to the competition anticipated. Citrus fruits are always strongly represented at Umtali, and this year's entries again demonstrated the capabilities of the district for the growing of this particular fruit. Interesting exhibits of timbers inside and outside the hall afforded ocular evidence that utilisation of our sylvan resources is receiving much attention in the Umtali district. In the cattle section the Frieslands were the

main centre of attraction, and some good specimens of the famous dairy breed were on view. The butter exhibited was of good quality, but the entries were not so numerous as last year. This may be taken as a good sign, because no development of the dairying industry can be expected if farmers continue to carry on dairying by individual effort. The cheese exhibits were more numerous than in previous years, and the quality of the winning entries was extremely good. The cheese which won the first prize came from the Lomagundi district. There was a big improvement in the poultry exhibits as compared with the previous year. Although the majority of entries were by two individuals, it is gratifying to note that there were new exhibitors. The Rhode Island Reds were especially good, while White Leghorns were excellent. Several Brown Leghorns imported from the Union were on view and made an interesting exhibit. The entries in eggs were very good both in number and quality. This can be attributed to the interest created by the egg circle, which is well supported by local poultrymen, and is, we understand, operating successfully.

There were many other features of interest too numerous to mention in this brief survey. Suffice it to say that the show enabled one to realise in a good measure the potentialities of this well endowed district and fulfilled its purpose of providing the healthy rivalry so essential for the advancement of the agricultural and allied industries.

**The Gwelo Show.**—It is pleasing to record that in spite of the difficult times, which we may emphasise are due to conditions obtaining outside of Rhodesia, a very successful show was held at Gwelo on the 5th and 6th July. The great improvement which was evidenced in practically all classes of exhibits is an indication of the progress which is being made in the face of discouraging circumstances and a sign of faith in the future. Farming in Southern Rhodesia is fundamentally sound, a fact which is borne out by shows such as the one held at Gwelo. The show attracted a large concourse of farmers from all parts of the Midlands, as well as townspeople of Gwelo, and for two days the town was bustling with activity. The cattle exhibits were fewer in numbers—a sign of the depressed times—but all the principal breeds were represented. The grade classes of cows, heifers and fat stock were better filled than were the classes for pure-bred cattle. In the bull classes young animals of quality were few, but some of the old bulls were good specimens of the respective breeds. There was also a lack of high class females, a matter we should like to see remedied in the future.

There was a greater number of entries of farm butter than formerly. This is not altogether to be commended, because the creamery situated on the spot is not getting adequate support from the local cream producers. It must be remembered that were it not for the creamery, butter would be subject to wide fluctuations in price. So long as farmers compete among themselves prices will never be satisfactory. The special prize awarded by the Lalapansi Farmers' Association for cheese caused a great amount of competition, and cheeses

from all parts of Mashonaland and the Midlands were exhibited. The quality, considering that the cheese-makers in almost every instance were exhibiting for the first time, was most creditable. The prize-winning cheese was sent from a farmer in the Lomagundi district. We look for a greater production of cheese in the Midlands, for there are good markets locally, at Que Que, Gatooma, and other mining centres which are at present largely supplied by producers outside the Territory.

There was an immense improvement over last year in the quality of poultry exhibited, and poultrymen apparently realise that they must put on good birds to gain an award. There was a very fine entry of Black Orpingtons, while White Leghorns were strongly represented. Ducks were a good class, four breeds being shown. The chief surprise was the egg classes, in which the entries were very numerous and competition very keen. The eggs were very large and the quality good. The three egg circle depots competed, and the first prize for thirty dozen eggs packed for export went to Bulawayo.

In the domestic sections competition was very keen, evidencing the fact that a great amount of interest is taken in this portion of the programme.

The maize and produce classes reflected the excellence of the season in Matabeleland, and competition was very keen. There were thirteen entries for maize in bags and seventeen entries for 10 cobs of Hickory King. The former was of high general excellence. Sunflower seeds in sacks were a strong class, there being no less than fifteen entries. There is at present a ready market overseas for this crop at a remunerative price. There were eight entries in the ground nut class, eight in the potato classes, and nine of velvet beans, of which extraordinarily good samples were on view. These classes have lacked support in former years, but they are now evidently getting the attention they merit, a welcome sign of the progress being made in arable farming.

The Midlands Agricultural Society is to be congratulated upon the success of this year's show, and we trust this will act as an incentive to future effort.

**The Sinoia Show.**—From a modest beginning as a farmers' gathering of primarily a social nature, the agricultural show of the Lomagundi district has developed, until to-day it is an event of no small importance. As a means of demonstrating the resources of this fruitful district, and of bringing farmers together for an interchange of ideas, the show was quite a success. As was to be expected, the quality of the produce was excellent, and compared well with that seen at other district shows. Several of our principal exhibitors of maize hail from this district, and the maize exhibits, therefore, were exceptionally good. The Salisbury White classes were not well filled, due to the fact that a number of competitors entered maize under the "Any other variety" class which should have been entered as Salisbury White. Several newcomers to the district gained awards

in the prize list, a matter of satisfaction to all concerned with the progress of the district. Though the quality of the cattle was good, it is to be regretted that there was little competition except in those unsatisfactory classes in which different breeds are brought into the ring together. There are several notable breeders in the neighbourhood, but unfortunately each one favours a separate breed. Major Percy Inskipp, who opened the show, paid a well-deserved tribute to Mr. J. S. Struthers, who has consistently adhered to the breeding of Friesland cattle. His example in the face of great difficulties has done much to encourage dairying in this area. The cheese and butter exhibits were of good quality, and it is interesting to note that cheese-making on commercial lines is progressing favourably. Having passed through the experimental stage, important developments may be expected. Citrus fruits are always a strong class at Sinoia, and this year's exhibits fully maintained the high standard of merit looked for. The announcement by Major Inskipp of a policy of sub-division of the British South Africa Company's citrus estates into small holdings is of great importance, and details will be awaited with much interest. The entries for the poultry section were numerous, and in many of the classes the quality of the birds was excellent. The birds were as a rule nicely prepared for exhibition, a feature which is often absent at district shows. There were good specimens of White Leghorns, Australian Utility Black Orpingtons, Red and Light Sussex, Rhode Island Reds, Black Leghorns, White Wyandottes, Anconas, Minorcas and Black Mendals, Pekin and White Indian Runner Ducks, and American Bronze Turkeys. The egg exhibits were fairly numerous and of good quality.

There were certain novelties at this show specially deserving of mention. A most ingenious pig and baboon scaring device was shown by its inventor, Mr. C. S. Larter, of Armadale, Banket. This contrivance is made out of three paraffin tins and a few rough native poles. A few stones are placed in a paraffin tin attached to the two arms of a simple windmill, the fans of which are made out of the other two paraffin tins, whilst the directing tail is made out of the bottoms and tops of the same tins. The drum revolves slowly, and the contained stones make the noise which is calculated to disturb the vermin. The device is certainly one which deserves extensive trial by our farmers, as it seems admirably calculated to make night hideous.

Another feature of interest not usually seen at agricultural shows was an array of ladies' bonnets and hats of various exquisite colourings and fine texture, made by Mrs. McDonald chiefly from the leaves of palm trees. These had been bleached and dyed and were skilfully formed into all manner of modern shapes, comprising sun-bonnets, motor-bonnets, picture hats, turbans and toques.

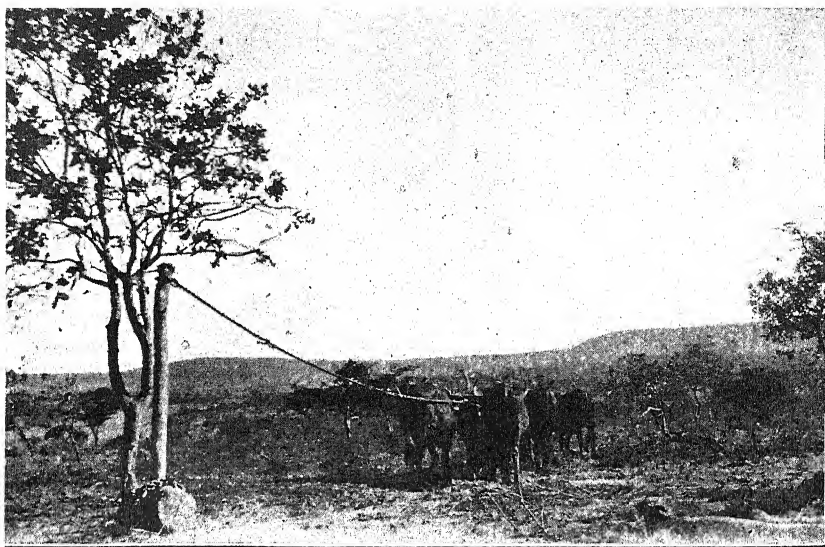
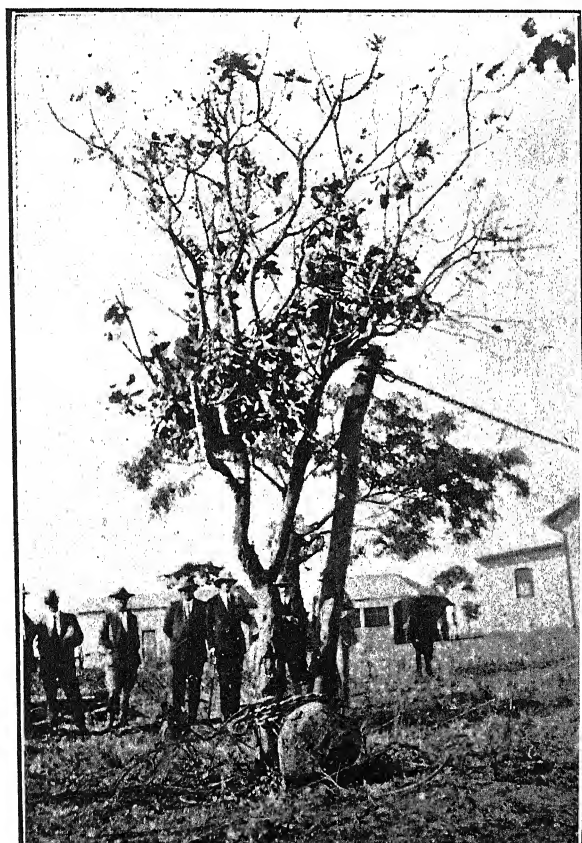
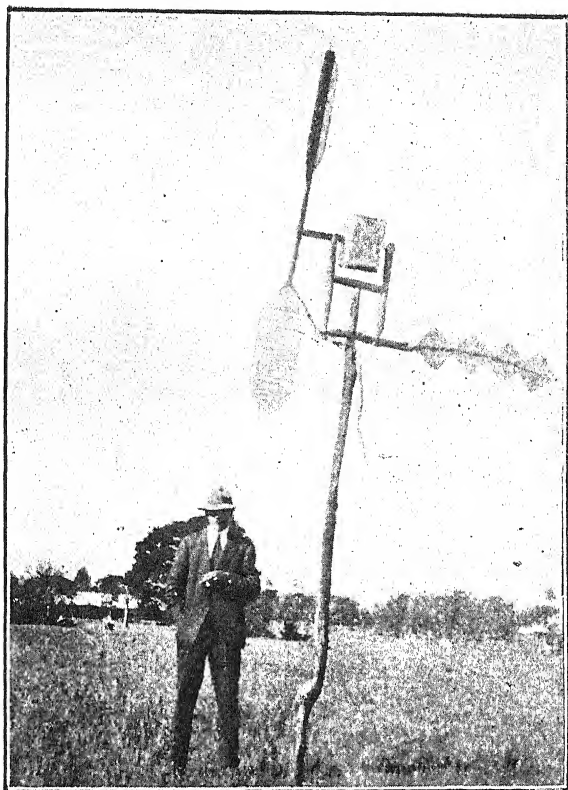


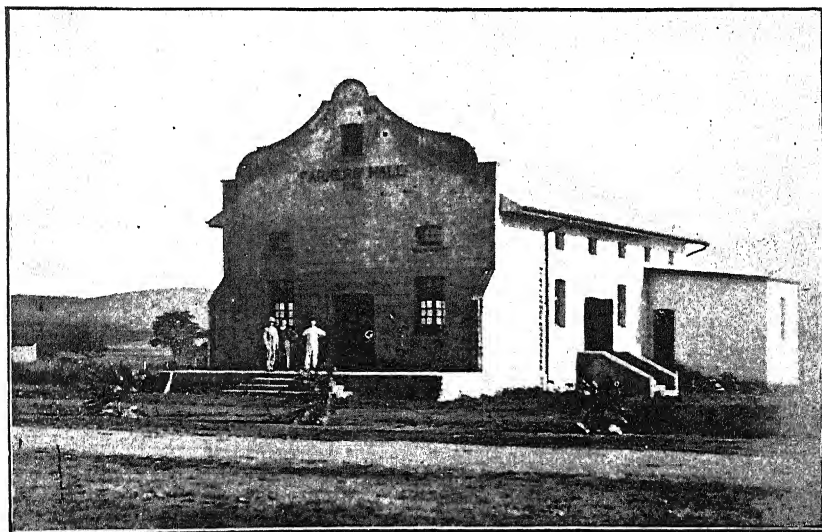
Fig. 1. A simple stump-puller. (See editorial note.)







Device for scaring wild pigs and baboons.



Farmers' Hall, Sinoia.





# The Growing of Virginia Tobacco in Southern Rhodesia.

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## FIELD OPERATIONS.

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By H. W. TAYLOR, B.Agr.

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The tobacco plant is influenced greatly by the environment in which it is grown. Different soils and different climatic conditions produce changes in the characteristics of the cured product to a marked extent. This fact is well illustrated by the different types of tobacco which are produced in the various sections of each tobacco-producing country. For instance, the several tobacco-producing areas in the United States of America each produce a distinct commercial class of leaf; in Cuba the several districts produce tobacco which varies considerably as regards value and use; Sumatra produces tobacco of a special type, and the same is true of the Levant.

In South Africa each of the major tobacco-growing areas produces leaf which has distinct characteristics. Thus, the Magaliesberg area is noted for pipe tobacco, the Western Province for Turkish tobacco, Natal for cigar tobacco and Rhodesia for Virginia tobacco.

The term "Virginia," as used in South Africa, denotes tobacco grown from varieties originating in America, and to distinguish the product from that produced from so-called Turkish varieties. The term is therefore rather a loose one, and applies to both dark and bright types, whether air-cured, sun-cured or flue-cured.

**Climatic Conditions.**—For producing Virginia tobacco of the best quality the rainfall should be moderate, but well distributed throughout the growing season, and rather light during the ripening and harvesting period. The precipitation should be in gentle showers rather than heavy downpours, and there should be plenty of sunshine. At transplanting time the weather conditions most desired are misty, dull days, with frequent showers. Under these conditions the transplants strike root quickly, and very few fail to grow. As soon as the transplants are established, sunshine is necessary to accelerate growth. A rainfall of 25 to 30 inches is sufficient for Virginia tobacco culture, provided it is properly distributed. In Southern Rhodesia the rainfall is ample for the culture of Virginia tobacco in those districts where the crop is being grown, and the average annual distribution is fairly uniform. The

country does, of course, suffer from drought in certain seasons and excessive rainfall in others. Of the two evils, a drought is preferable to excessive rainfall.

The growing season should be free from hailstorms. The value of the tobacco plant lies in its foliage, and this is easily destroyed by hail. Fortunately hailstorms only occur at rare intervals in Southern Rhodesia, and are generally local, so that very little damage occurs from this cause.

As the tobacco plant is very susceptible to injury by frost, the growing period must be sufficiently long to allow the plants to mature and be harvested before the first frost occurs. The young plants can be protected from slight frost whilst in the seed-beds, and the plants should reach maturity and be ready for harvesting in from 90 to 120 days from the time they are transplanted into the field. The growing season should therefore be of at least four months' duration. The growing season is considerably longer in Southern Rhodesia.

Excepting abnormal seasons, the climatic conditions over the greater part of Southern Rhodesia are suitable for the culture of Virginia tobacco.

**Soils.**—Tobacco can be grown in almost any soil, provided it is well drained, fertile, and the climatic conditions are favourable; but, the various types of tobacco must be grown on soils suited for the class of leaf desired, in order to make tobacco-growing a profitable industry.

In Southern Rhodesia tobacco cultivation is generally confined to three types of soil, viz., sandy loams of granitic or sandstone origin; contact soils, which are found where granite and diorite, granite and schist, or granite and banded ironstone are in contact; or on clay loams, which are derived from diorite, schist or banded ironstone. The tobacco produced on each distinct type of soil has characteristics which distinguish the leaf from that produced on the other distinct types.

Sandy loam soils vary in colour from almost white to pink, and are sometimes practically black where highly impregnated with organic matter. The surface soil is usually shallow—from 4 to 8 inches in depth—and poor in plant food. They are more generally used for tobacco cultivation than any other soils in Southern Rhodesia, and when properly handled produce fair yields of bright leaf which is of good quality.

The contact soils are also sandy loams, but are finer in texture and produce heavier yields of tobacco. This type of soil is not found in large continuous areas, but is probably the best soil for producing Virginia tobacco which is found in South Africa. These soils produce bright leaf which has fine, firm, silky texture, with elasticity and good body.

The soils derived from diorite, schist or banded ironstone are usually red in colour, and may generally be classed as clay loams. These soils are usually fertile and produce good yields. For the first year the leaf produced is fairly bright in colour, but becomes darker with successive cropping. The tobacco produced on these soils is

usually of poor quality after the second year. The colour is dark, but the leaf lacks body and substance, and is of little value. Typical soil of this type is not recommended for tobacco culture.

The texture of the soil used exerts, either directly or indirectly, a marked influence on the yield and quality of the tobacco produced. Sandy soils of coarse texture, unless heavily fertilised, usually return poor yields of leaf, which is light in body and colour, lacking in fineness, inclined to be brittle and lifeless, and generally of chaffy, indifferent quality. Sandy soils of fine texture, when properly fertilised, produce large yields of silky, elastic leaf, which has good body and bright uniform colour.

The character of the sub-soil also has an important influence on the production and quality of tobacco grown on any type of soil. If the sub-soil is impervious, the plants will in certain seasons suffer from an excess of moisture, and if the sub-soil is excessively porous, the crop may suffer from drought in seasons of light rainfall, and such soil is not retentive of fertilisers. If the sub-soil is of a clayey nature and is too near the surface, the tobacco produced thereon is usually dark, even though the shallow surface soil may be otherwise suitable for the production of bright leaf.

The ideal soil for the production of bright tobacco should be composed of about 70 per cent. of fine sand, together with 6 to 8 per cent. of clay, besides silt and organic matter. The depth should be from 6 to 12 inches. The sub-soil should not be impervious, but at the same time should be retentive of moisture. If the sub-soil is made up of fairly equal proportions of sand and clay, it retains the moisture and at the same time allows for drainage.

For dark tobacco the best soils contain about 50 per cent. of clay with 25 per cent. of sand, as well as silt and organic matter. In depth they should be from 6 to 12 inches, and the sub-soil should be somewhat heavier than for bright tobacco.

Between these two types all classes of soil are found, so that the tobacco produced ranges in colour from bright yellow to very dark brown, according to the type of soil upon which it is grown and the manner in which it is handled and cured.

Regardless of the type of soil used, unless it is well drained profitable crops of tobacco cannot be produced. For this reason vlei and other wet soils cannot be used for tobacco, even if they are suitable in other respects. Low-lying soils and soils at the base of long ridges should, therefore, be used with caution.

Generally speaking, the best quality tobacco is produced on new lands, and this is particularly true of sandy soils. This appears to be due to the fact that newly cleared soil contains a large amount of humus, which is beneficial to the mechanical condition and assists in the retention of the proper amount of moisture. Sandy soils which are continuously cultivated will not produce leaf of the best quality, regardless of the amount of fertilisers applied. Tobacco soils should, therefore, be so handled that the humus contents are maintained during the time devoted to this crop.

**Preparation of the Soil.**—In order to produce tobacco of the best quality, the plants should make continuous and fairly rapid growth from the time the transplants strike roots until they approach maturity. For this reason the soil should be brought into good tilth and fertility before transplanting. Proper preparation of the soil before transplanting saves cultivation later, and paves the way for larger yields of marketable tobacco.

When possible the land should be ploughed in the autumn and re-ploughed before transplanting. This helps to rid the soil of insect pests and weeds and makes it more friable. Land should not be broken deeper than the surface layer of soil, if the best results are to be obtained. In Southern Rhodesia the soil is inclined to be shallow, so that deep ploughing, for tobacco, must be practised with extreme caution.

When possible new lands should be cleared and ploughed during the rainy season previous to planting. The soil can be properly ploughed at this time, and all vegetable matter turned under will be converted into humus, which greatly increases production. Soil under cultivation should be ploughed as soon as possible after the crop is removed. If green manuring is practised, the improvement crop should always be turned under during the rainy season, for the reason above mentioned. In each case the soil should be ploughed a second time, preferably after it has become moist from the early rains.

After the second ploughing the soil is brought into fine tilth with harrows before the field is aligned for transplanting.

**Fertilisers for Virginia Tobacco.**—In Southern Rhodesia practically all Virginia tobacco is grown on light, sandy soils. These soils are naturally unfertile, but respond readily to applications of fertilisers or manure. To obtain satisfactory yields of good quality leaf, a complete fertiliser, that is, one containing nitrogen, phosphoric oxide and potash, is required.

Each of the three elements of fertility has a special effect upon the quality and quantity of leaf produced, so that the action of each should be understood by every tobacco grower.

Nitrogen hastens and increases leaf production in all plants. If used in tobacco production in the proper proportion, it increases the total yield and adds body to the leaf. However, Mathewson\* states that "too much nitrogen, especially if unsupported by a sufficiency of other fertilising compounds, particularly phosphates, will make the tobacco coarse, dark and late in maturing, with a tendency to damage by 'red fire' or dead spots here and there on the leaves." On the other hand, a lack of nitrogen reduces the yield, and the tobacco produced will be small, thin and papery, although the leaf may be bright.

Potash aids in leaf production, and, it is thought, also tends to diminish or prevent leaf "specking." This element, in the form of sulphate, carbonate or nitrate, also improves the burning properties of tobacco and induces body in the leaf.

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\*E. H. Mathewson, Bulletin No. 16, U.S.D.A.



Plate I. Plants on right fertilised before transplanting; those on left after transplanting. All tobacco transplanted the same day. Great B Farm, property of Mr. A. C. Henderson.



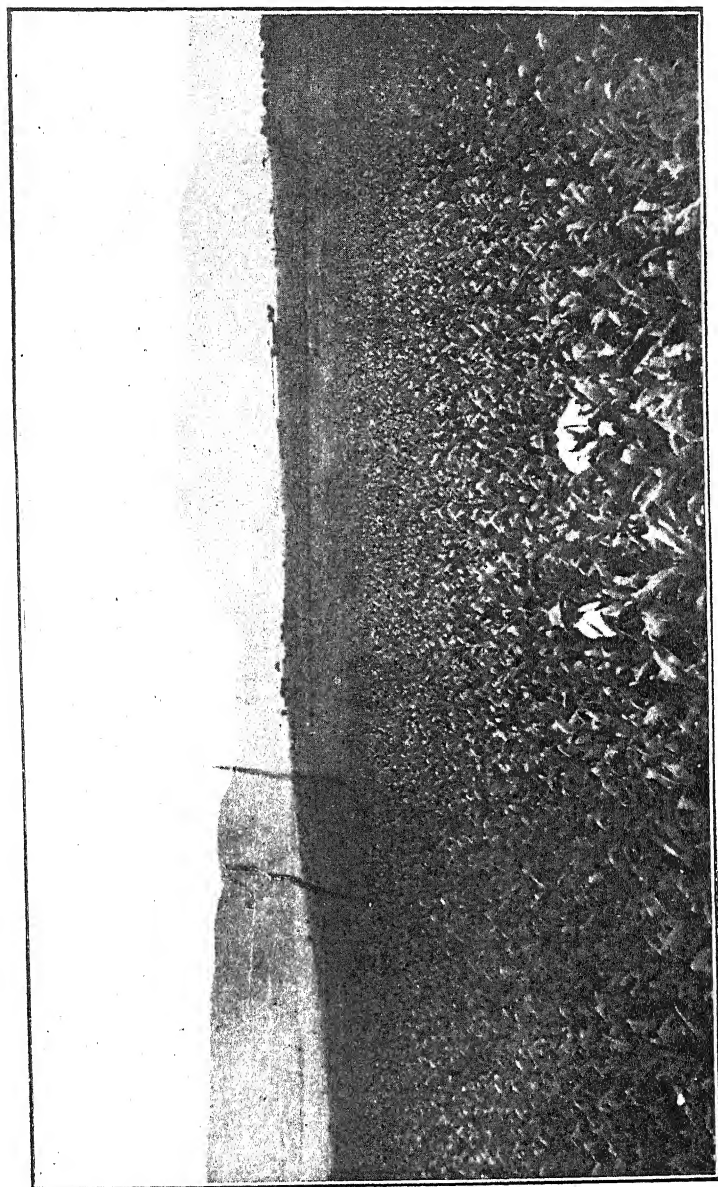


Plate II. Field of tobacco topped to produce the optimum yield. (Great B Farm, Mazoe, property of Mr. A. C. Henderson.)





Phosphates assist in increasing leaf development and hasten maturity. This element also aids in the production of bright leaf through its decided effect in ripening the plants. Soils which have an accumulation of nitrogenous materials through ploughing under leguminous plants are, therefore, especially benefited by liberal applications of phosphatic fertilisers. On light sandy soils, which are poor in nitrogen, phosphates must be used with discretion, as excessive applications tend to cause premature ripening or "firing," especially during dry weather.

The amount of fertiliser to apply per acre depends upon the fertility of the soil used and the proportions of the several elements of plant food used in the fertilising mixture.

Light applications give the plants a good start, but do not carry sufficient plant food to produce a normal yield per acre, so that no economy is effected. Light applications of fertilisers produce small leaf of poor body, which, although bright in colour, is usually unprofitable on account of the light yield. On the other hand, too heavy applications of fertilisers produce large yields of coarse, heavy tobacco which is difficult to cure and usually of indifferent quality. In this connection it should be pointed out that during seasons when "angular spot" and "wildfire" are prevalent coarse, rank-growing plants are more susceptible to these diseases than plants of less vigorous growth. Fromme and Wingard† have shown that the infection of "angular spot" is increased by heavy applications of fertilisers. Their results have been corroborated by other investigators in America, and this has also been noted in Southern Rhodesia.

It is clear then that fertilisers must be applied with considerable judgment to obtain satisfactory results. Light applications are unprofitable on account of low yields, while heavy applications may produce leaf of indifferent quality, and may cause a pre-disposition to disease due to coarse, heavy growth. It would, therefore, appear that the middle course is the safest to adopt, and that medium applications of fertilisers will in most seasons produce the most profitable results. It is thought that for the ordinary sandy soil an application of 150 lbs. per acre of a double complete tobacco fertiliser will produce a normal yield without inducing rank growth, which is susceptible to disease. The formula for tobacco double complete fertiliser is made up of water soluble components as follows:—Phosphoric oxide, 20 per cent.; nitrogen, 8 per cent.; and potash, 10 per cent. If lower grade fertilisers are used, the bulk should be increased proportionately.

The time and manner of applying fertilisers are also of considerable importance. The usual practice is to apply fertiliser around the plants after growth begins. Some growers transplant their whole crop before commencing to fertilise, with the result that practically the whole crop comes to maturity at the same time. This would be no disadvantage if sufficient labour and barn accommodation were available to handle the whole crop in a short time, but this is seldom the case.

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†"Black Fire or Angular Leaf Spot of Tobacco." Technical Bulletin No. 25, Virginia Agricultural Experiment Station.

When barn accommodation is limited and labour is dear and difficult to obtain at short notice, it is best to fertilise the first half of the crop before transplanting. Fertilising before transplanting will hasten maturity (see Plate I.) by at least two weeks, and so allow of the first part of the crop being harvested before the remainder is ripe. In fertilising before transplanting, holes are made in the ridges at correct intervals, the requisite amount of fertiliser is placed therein, the fertiliser is mixed with the soil and the hole partially filled. Sufficient rain for a planting "season" will place the fertiliser in solution, and as the plants are transplanted at the spot where the fertiliser is placed, they receive a liberal amount of soluble plant food as soon as they begin to grow.

Commercial fertilisers, on account of the ease of application, their ready availability and small bulk for transport, must remain the principal source of plant food for tobacco growing. Kraal manure can, however, be used to advantage on light sandy soils for tobacco production. To obtain satisfactory results, kraal manure must be old and well decomposed. It is best applied broadcast at the rate of 6 to 8 tons per acre, and should be well incorporated with the soil through ploughing. It is best applied some time before transplanting, so that further decomposition may take place, in order that the plant food may be immediately available. It is sometimes said that bright tobacco of good quality cannot be produced with kraal manure, but practical results do not coincide with this statement.

**Rotation of Crops.**—Maintenance of the humus contents of the soil is of the utmost importance for profitable tobacco production. Newly cleared soils contain a large amount of humus, and this is generally given as the principal reason why new soils produce high yields of good quality tobacco. The humus of new soils is mainly derived from the decomposition of leaves, twigs and grass, and, although this form of organic matter has a low nitrogen content, it is particularly suitable for tobacco production.

The source from which the humus of newly cleared soils is derived gives a key to suitable crops to grow in rotation with tobacco in order to maintain a proper supply of decomposed organic matter. Plants of the grass family are generally more suitable than leguminous crops for green manuring tobacco lands, and this would apply more particularly to the heavier soils. Rye is recommended as a suitable crop for improving tobacco soils, and should be turned under just before the seed heads appear. On very light sandy soils, leguminous crops can be used to good advantage. On such soils velvet beans, kaffir beans or cow peas can be grown for manurial purposes. If legumes are utilised for green manuring on heavy soils, tobacco should not be grown the following season unless the grower wishes to produce dark, heavy leaf.

No definite rotation can be laid down, as existing soil and climatic conditions largely determine the crop to be grown for improvement purposes. Market conditions also largely determine the crop or crops to be used in the rotation other than tobacco and the improvement crop. It is thought that a green manuring crop should be grown and ploughed under once in three years, in order to maintain a proper supply of

humus in the soil for profitable tobacco production. Regardless of the green manuring crop used for soil improvement, it should be turned under during the rainy months in order that the vegetation may decompose before the following season.

**Varieties to Grow.**—For bright tobacco Hickory Pryor has given uniformly good results, and this variety also produces medium bright leaf of excellent quality. Goldfinder and Hester are also standard varieties for the production of bright and medium leaf. Warne, on good soil, produces excellent medium and dark tobacco, and when grown on light soils cures out very bright, but as a bright variety the yield is usually disappointing. South's gives excellent results in certain localities, but cannot be generally recommended.

Growers are strongly urged to use only locally-grown seed, as the past season has further demonstrated that imported seed is not always of the intended variety; and, furthermore, tobacco grown from imported seed is more susceptible to disease than that grown from seed which has become acclimatised.

**Transplanting.**—When the seedlings are from four to six inches in height they are ready for transplanting. In order to hasten transplanting some growers use smaller plants. If the weather conditions are favourable small transplants will grow, but a few hours of hot sun immediately after transplanting will kill or severely retard the growth of small transplants. On the other hand, overgrown, tough and woody plants are often used to obtain the intended acreage. Such plants rarely make satisfactory growth. As a rule the flower head appears whilst the plants are small, and after topping the leaves remain small and do not ripen normally. The tobacco harvested from such plants is usually very small and inferior, and the additional acreage obtained through using unsuitable transplants is almost always grown at a loss.

In order to obtain the intended acreage growers often transplant after the first week in January. Experience is the best guide as to the proper time for planting farm crops in any country. It has been ascertained from actual results that, in Rhodesia, the best yields and best quality tobacco are obtained when the crop is transplanted during the latter part of November and December. Tobacco transplanted after the first week in January rarely produces leaf of satisfactory quality. Tobacco transplanted at the proper time grows rapidly and matures while the weather is warm and before the rains have ceased, so that the leaf yellows well on the land and is easily cured. If transplanted after the first week in January, tobacco usually reaches maturity when the nights are cool, the soil and atmosphere are dry, and does not yellow in the field. The leaf, although small, is usually heavy, coarse and leathery, and hence difficult to cure. In this connection it should be stated that in every part of the world where bright tobacco is produced, late planting is considered undesirable. Hart\* states:—"To get best results with bright tobacco, it is essential that the crop be planted as soon as the weather warms up sufficiently in the spring and

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\*J. C. Hart, "Production of Bright Tobacco." Bulletin No. 62, Virginia Agricultural and Mechanical College.

the plants are ready for transplanting. It is desirable to have tobacco off the hill (harvested) before the cold nights, as it is impossible to get as good colour then as with tobacco cured during the warm weather of August and early September." Mathewson† states that "Tobacco which reaches maturity and is harvested while the weather is yet warm generally will be decidedly better in quality, particularly in respect to colour, than later cuttings. Growers should make a strenuous effort to have an early crop by planting early and by choosing land on which the plants will grow quickly." In Nyasaland also late planted tobacco generally produces low grade leaf. If the major portion of the intended acreage has been transplanted by the first week in January the remainder should be planted to other crops, and additional care given to the acreage transplanted in order to increase the yield and improve the quality. Tobacco growers in Southern Rhodesia are therefore strongly advised to discontinue transplanting after the first week in January. If it is found to be absolutely necessary to plant out later than this time, that portion of the crop should be given an additional application of water soluble fertiliser in order to hasten the maturity of the plants.

One of the primary causes for low yields in Rhodesia is the imperfect stand of plants in tobacco fields. This may be caused by weather conditions, insect pests or bad transplanting. In any case the blanks in every row should be filled in as soon as possible after the first transplanting in order to secure a practically perfect stand. The proper distance for transplanting tobacco is at intervals of three feet in rows, with the rows three feet apart. If the plants grow to medium size six plants should be the maximum required to produce one pound of cured tobacco, which at the above distance of planting would give a yield of 800 lbs. per acre. The average yield last season was only 404 lbs. per acre, which indicates that either the stand was very poor, or that the plants made poor growth, or both. In order that tobacco may be grown at a profit the stand of plants should not be less than 75 per cent.

Tobacco should be transplanted on ridges, and this applies particularly to crops grown on sandy soil. Soils of this type easily become saturated with moisture during heavy rains, when the plants are drowned or have their growth severely checked. Ridging provides drainage under such circumstances. As stated previously, sandy soils are usually shallow. The operation of ridging increases the depth of surface soil in which the plants grow, and hence provides a larger supply of plant food. Ridges should be 3 ft. apart and the plants are spaced at intervals of 3 ft. in the ridges. Ridges should follow the natural drainage slope of the land. Transplanting is best done on dull cloudy days when the soil has become thoroughly moistened by rains.

**Cultivation.**—As soon as the transplants have become established in the soil, cultivation should be commenced. Care should be taken not to disturb the roots of the newly established plants through the cultural operations. When the plants begin to grow properly a deeper cultivation or hoeing should follow, in order to aerate and mellow the soil. There-

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†E. H. Mathewson, "The Culture of Flue-cured Tobacco." Bulletin No. 16, U.S. Department of Agriculture.

after cultivation should be shallow, and when the plants are ready for topping cultivation should cease. Hand cultivation should not be neglected, regardless of the method of transplanting. Some growers fail to use hand hoes sufficiently, and suffer loss through both yield and quality of leaf. When ridged the hand hoe and wing-shovel are the only cultural implements required for cultivation. The number of cultivations required will vary with the soil and climatic conditions, but the aim should be to prevent the growth of weeds and grass between the plants and to maintain a fine loose mulch on the surface of the soil.

**Topping and Suckering.**—The operation of removing the terminal bud, to prevent seed development, is called "topping." The general tendency is for growers to top too high. This practice does not increase the yield, but does increase the percentage of short leaf. When the plants are topped too high the leaves do not develop body, and the top leaves are very small, narrow and late in maturing. On the other hand, if topped too low the tobacco develops coarse, heavy leaves which are difficult to cure. To top tobacco properly, both experience and judgment are required.

The height of topping also has an important relation to the severity of infection from "angular spot" and wildfire." Plants topped too low are more severely damaged by these diseases than tobacco topped too high. Fromme and Wingard\* carried out an experiment in this connection, the results of which are given by them in the following table:—

| Height topped. | Degree of infection. | Yield in pounds. | Percentage by grades. |         |       |
|----------------|----------------------|------------------|-----------------------|---------|-------|
|                |                      |                  | Longs.                | Shorts. | Lugs. |
| 8 leaves       | Very severe          | 31               | —                     | —       | 100   |
| 9 "            | " "                  | 35               | 11                    | 6       | 83    |
| 10 "           | Severe               | 40               | 15                    | 21      | 64    |
| 11 "           | "                    | 37               | 14                    | 24      | 62    |
| 12 "           | Moderate             | 34               | —                     | 9       | 91    |
| 13 "           | "                    | 34               | —                     | 18      | 82    |
| 14 "           | "                    | 43               | —                     | 21      | 79    |

In topping, therefore, the middle course should be adopted. Top to produce the maximum yield without producing heavy leaf which will be practically destroyed by disease during a season when "angular spot" and "wildfire" are prevalent. As heavy, wind-driven rain is the

\*"Black Fire or Angular Leaf Spot of Tobacco." Technical Bulletin No. 25, Virginia Agricultural Experiment Station.

principal agent in disseminating these diseases, it follows that tobacco should be topped higher during a season of heavy rainfall than when droughts occur. It is, of course, impossible for growers to predict climatic conditions so that they could with safety top rather on the high side—leaving say 12 leaves—in order to avoid disease even at the expense of yield.

Many growers wait until the plants are in full flower before starting to top their tobacco. This is a mistake, as an enormous amount of plant food is wasted in the development of the flower head and discarded leaves. Also the stalk becomes hard as the flower head develops, and the operation of topping is rendered more difficult. The proper time to top tobacco is when the requisite number of leaves have developed and while the stem of the plant is soft and succulent (see Plate II.).

About ten days after topping, suckers will appear in the axils of the leaves, and these must be removed or the whole object of topping will be defeated. If suckers are allowed to grow, the yield per acre will be reduced and the quality of the cured leaf will be seriously affected. In this connection Selby and Houser\* have carried out an interesting experiment, the results of which are given in the following table:—

| Method of suckering.         | Cost of suckering per acre. | Yield per acre in pounds. | Value of tobacco per acre. | Gain over suckering but once at cutting time. |                    |
|------------------------------|-----------------------------|---------------------------|----------------------------|-----------------------------------------------|--------------------|
|                              |                             |                           |                            | Pounds per acre.                              | Value of increase. |
| Once just before cutting     | \$3.74                      | 953                       | \$85.95                    | ...                                           | ...                |
| Once one week before cutting | \$3.18                      | 1,079                     | \$98.30                    | 126                                           | \$12.35            |
| Twice                        | \$3.40                      | 1,146                     | \$106.02                   | 193                                           | \$20.07            |
| Three times                  | \$3.96                      | 1,200                     | \$110.43                   | 247                                           | \$24.53            |

Note.—Cutting is harvesting the whole plant.

Some growers maintain that suckers should be allowed to grow in order to produce bright leaf, but this is usually an excuse for bad handling of the crop, when the acreage planted is in excess of the labour available. However, when a period of wet weather occurs just as the tobacco is ripening, it may be an advantage to allow suckers to grow temporarily, as their growth will tend to absorb plant food and prevent second growth of the plants, which causes the leaf to become coarse and difficult to cure.

**Acreage.**—Most tobacco growers transplant more tobacco than can be properly handled with their complement of labour and curing

\*"Tobacco Culture in Ohio." Bulletin No. 238, Ohio Agricultural Experiment Station.

facilities. Many of them frankly admit that their acreage is greater than can be properly handled, but excuse the practice by saying that they will only harvest the best leaf. There can be little doubt that this is their original intention, but when the marketable leaf has been harvested and cured they continue with inferior tobacco until frost forces them to cease their misdirected efforts. Transplanting a larger acreage than can be handled is wrong both in theory and practice. It results in the production of a high percentage of very inferior tobacco, which reduces the average price for the leaf of good quality and gives the grower a false impression as to the real value of marketable tobacco. The cost of preparing, fertilising, transplanting, cultivating, harvesting and curing the additional acreage is very considerable and usually results in producing the whole crop at a loss. If the additional labour and fertiliser were used in growing, harvesting and handling the proper acreage, the yields would be higher, the quality of the cured leaf would be greatly improved and the crop would be grown at a profit instead of at a loss.

As labour is generally available, curing and handling facilities are the limiting factors. In regard to curing facilities it can be safely stated that where the stand is good and the plants make satisfactory growth one barn (16 ft. by 16 ft. by 20 ft.) will not properly accommodate more than 10 to 12 acres unless the grower is very fortunate in being able to transplant his crop with intervals of about four weeks between plantings. For 50 acres of properly grown tobacco, four barns are necessary in order to handle the leaf at the proper time and without crowding the tobacco into the barns. With tobacco of normal size, a curing barn 16 ft. square and 20 ft. high will hold, when properly filled, approximately 800 sticks of tobacco. In order to get their whole crop cured, some growers place 1,200 sticks of tobacco in barns of this size and the results are unsatisfactory. Growers are therefore strongly urged to curtail their acreage to meet their available curing accommodation, or else to provide sufficient barns to handle properly any increase in acreage.

## The Cattle Industry.

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The outlook of the cattle interests in Southern Rhodesia is far from satisfactory. The heavy wet season experienced last year, though not so bad as a drought, is yet far from desirable so far as condition in the winter following is concerned. Travelling about the country one notices that cattle are not generally in as good condition as is expected at this time of year. At the shows held to date the numbers in the cattle classes have shown a reduction, and there seems to be an absence of new blood amongst exhibitors and stock alike. This can be very well understood, and anything else was hardly to be expected.

The cattle industry has been under discussion in the Legislative Council, but in the present transitional political situation decisive steps can hardly be looked for. None the less, matters are not altogether stationary in this respect, and developments at an early date are not impossible.

On account of the adverse prospects for the future, quite a number of cattlemen, including some of the most prominent, have purposely refrained from allowing their cows to breed. This practice is already having an effect on the birth-rate, and the set-back so caused must have a detrimental influence on the numbers of cattle in years to come and to generations yet unborn. This is most sincerely to be deplored in a country which is so far from being fully stocked, yet in view of the costs of rearing, dipping and particularly the income tax calculation of charges on the calf crop, the action of farmers is quite easy to understand.

Yet another dissatisfying feature of the present position is found in the fact that bulls are not in demand as they should be, especially if improvement is to be continued. The demand is slack and importations are fewer in numbers than formerly. Even grade bulls, if good, are better than none at all or than chance found scrubs. For those who can do so now is certainly the time to go in for the best bulls possible. It is yearly becoming more clear that it is the best that are most profitable.

Lately a good deal has been heard of spaying. No doubt the process encourages fattening, and there is no serious objection to it when skilfully performed. In the case of old cows it is to be commended, but where applied to young stock which might breed it effectually puts an end to propagation; and if, as we all hope, the present depression is to be soon dissipated; this may be a cause of regret in the near future. If applied to really inferior stock it is perhaps in present circumstances excusable as preventing the production of rubbish, but even native cows and scrubs can be induced to produce progeny much better than themselves by the use of good bulls, and this is



surely the preferable course where one can afford it. In the case of old cows and culls, especially animals known to be bad breeders, spaying has much to commend it.

Another operation, and one which deserves to be much more generally practised, especially in the case of higher grade stock, is the dehorning of calves, which, besides preventing many injuries, is calculated to assist the fattening process both on the veld and in stalls by rendering the animals harmless to each other and so peaceable and quiet.

The report of the Committee of Enquiry into the cattle industry was discussed in the Legislative Council on the motion of Mr. R. D. Gilchrist: "That this Council requests the Government to take into consideration the desirability of making financial provision for giving immediate effect to the recommendations made by the Committee of Enquiry, and otherwise in respect of the cattle industry of Southern Rhodesia." The mover reviewed the report at length and was supported by several members, who urged that the recommendations should be acted upon at once. The recommendations of the committee may be divided into certain distinct classes; first, those involving further enquiries by the committee and entailing but slight expenditure; secondly, those calling for immediate action, but without incurring expenditure at all, such as the replacement of beans by meat in the mine rations and the preparation of draft legislation for the inspection of live cattle prior to export, and so on; thirdly, matters entailing some outlay, such as expenses of visitors concerned in the meat trade, and propaganda at the Empire exhibition, and so forth; finally, far-reaching questions of policy which obviously should be left over for the incoming Government to consider. Under this last category fall such questions as loan schemes for fencing and for bulls, and negotiations with firms carrying on the business of meat export, which is probably the most important of any of the committee's recommendations.

The reception accorded to the report by the Legislative Council, and so far as it has been dealt with by the Press here and abroad, has been exceedingly favourable. Pious approval, however, is not enough to meet the position; action on the lines advocated is essential if many of our cattle breeders are to escape ruin.

Under an arrangement made in 1921 with the Administration of Northern Rhodesia export of cattle to the Congo is only permitted after 1st July in each year for a limited period. The conditions under which cattle are permitted to pass through Northern Rhodesia are being reviewed with regard to further export during the present year. At the time of writing nothing definite had been arranged, although facilities were being provided at Bulawayo for the inspection of stock *en route*.

It will interest breeders of Friesland cattle in Southern Rhodesia and those desirous of taking up the breed to learn that once again the Friesland Cattle Breeders' Association of South Africa is sending for sale and exhibition at both the forthcoming agricultural shows at Bulawayo and Salisbury a choice selection of registered high-class

Friesland bulls, cows and heifers. This year larger numbers than in the past are being sent up—in all, thirty-two head—and it is understood that these will be all very good animals indeed, and that the owners intend to sell them and do not look for any excessive prices.

The object of the Association and the breeders is a very legitimate one: to establish the breed in Southern Rhodesia, knowing that this is the best means of extending business in the future. It is of course very much to the advantage of breeders of Friesland cattle in Rhodesia at the present time to have opportunities of adding to their herds cattle of merit at moderate prices, and of selecting the animals themselves on the spot after arrival and after they have been adjudicated upon by the judges at the show.

The descriptive catalogue issued in connection with these sales gives the fullest particulars of the stock, not only as to ownership, age and pedigree, but, what is not possible in other cases, the actual milk records of the dams and grand dams in many instances. These cattle have all passed the tuberculin test and are guaranteed in sound health on day of sale. The published particulars, moreover, are guaranteed by the Association. Messrs. Woodin and Mellish, who have in past years attended our shows, will again accompany the cattle, and this in itself gives breeders, actual and prospective, the great advantage and privilege of consulting in person the expert officials of the breed society.

The cattle feeding demonstration at the Government Experiment Farm, Gwebi, is making good progress. Five lots of grade oxen, seven in each lot, showing Shorthorn, Hereford, Devon, Aberdeen Angus and Sussex crosses and one lot of scrubs, are being all fed on precisely the same ration and under identical conditions. All are doing well so far, and it is hoped to exhibit them at the Salisbury Show, where they may be expected to be a credit to their respective breeds, even if they do not carry off prizes against pens specially fattened for the show.

Farmers interested in stock feeding are strongly recommended to visit the farm and inspect the stock, when they can see for themselves the conditions under which the cattle are fed and obtain details of the treatment given.

We are given to understand that Messrs. Shift & Jacobson, of Gwelo, propose to again arrange a show and sale of fat stock at Christmas, of which early announcement is made in order that exhibitors may prepare their cattle in plenty of time. Handsome prizes will be offered, which, in view of the depression of values, will not perhaps be on quite the scale of past years.

This event has now come to be regarded as one of the principal opportunities in the year for competition amongst feeders as well as for the sale of their fat cattle, Gwelo worthily trying to uphold its reputation as a market for the finished article as well as a centre for obtaining breeding stock.



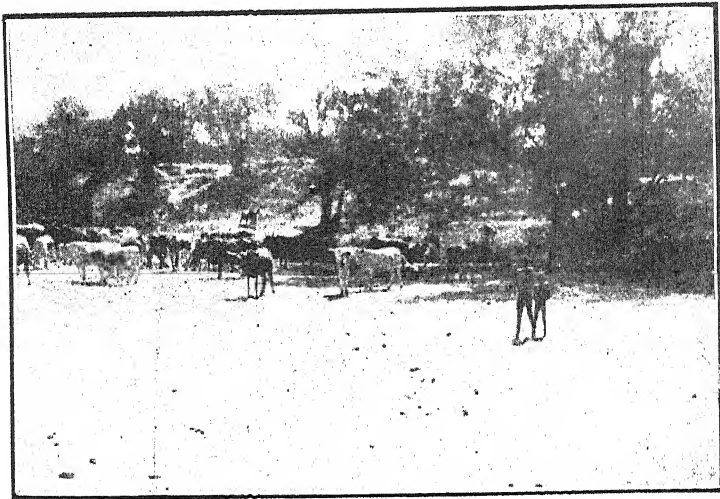


Fig. 1. Site of the drift; the sandy bed of the Gwaai River.

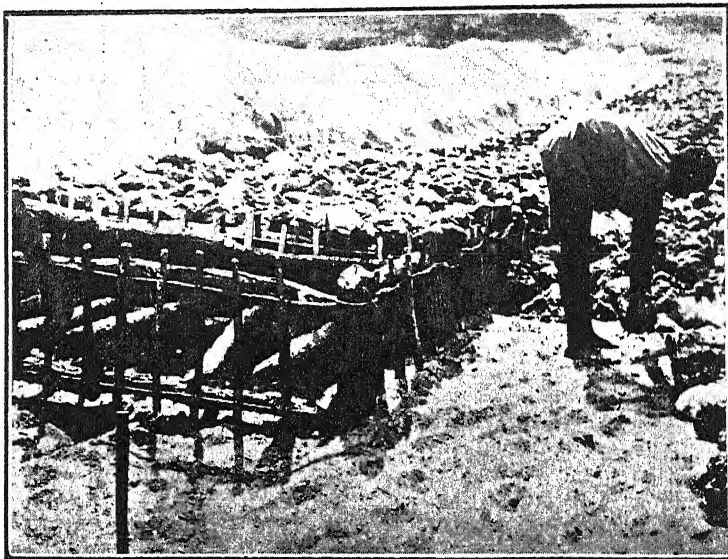


Fig. 2. Containing wall of crates bound with wire before and after packing with stones. On the right the road foundation is being laid on sand. Gwaai drift.





Fig. 3. On the upstream side of the crates; surfacing the roadway up to the level of the crates. Gwaai drift.

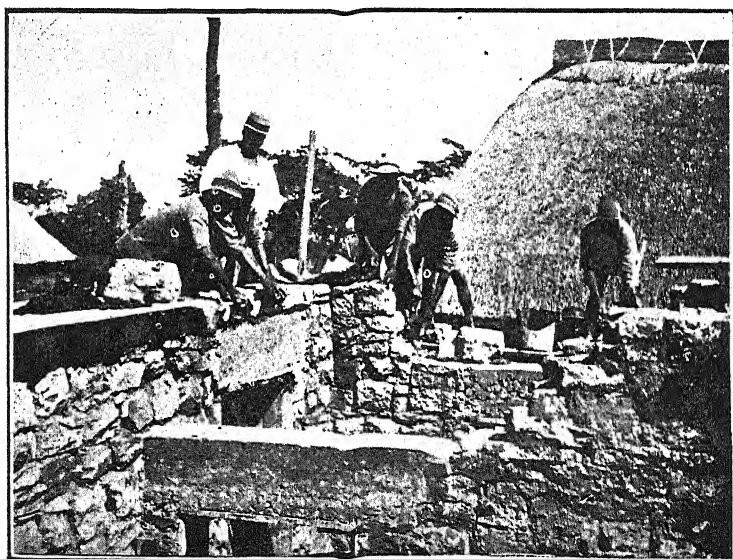


Fig. 4. Pupils building instructor's house of granite laid in dagga. The lintels are of re-inforced concrete. Domboshawa.

## Government Industrial Schools for Natives.

By GUY A. TAYLOR, M.A., Inspector of Native Development.

Two schools for natives have recently been opened in this Territory by the Native Development Department, of which Mr. H. S. Keigwin is Director. Both schools are situated in native reserves, one in Mashonaland and one in Matabeleland. The Chief Native Commissioner has laid down that the primary object of these schools is to teach the natives to make better use of the potential agricultural wealth of the reserves which have been set aside for them.

At first sight it may seem to the European farmer that native competition is being fostered by the Government. This might have been true while the European farmer depended only on local markets for the sale of his produce, but now that over-sea markets have to be supplied the co-operation of the native would seem to be most useful. With the help of the native the exportable surplus can be increased to such an extent that favourable contracts may be made with railway and steamship companies, and regular supplies assured to over-sea importers. In addition, there are some aspects of farming in which the question of competition between black and white cannot enter. There are crops which for one reason or another are almost impossible for the European farmer to grow at a profit. The native, on the other hand, with a lower standard of living and unlimited time and labour at his disposal, can grow them with profit to himself and his country.

Castor oil is one of the many crops which, owing to uneven ripening and other causes, are laborious and expensive to harvest, and would probably never pay the white farmer, though eminently suitable to the native farmer. Cotton, except under irrigation, is probably an uncertain crop for the white farmer in Southern Rhodesia. The native, on the other hand, with no hired labour and no overhead charges, can lose little or nothing in an unfavourable season. In a favourable season, with plenty of labour for his own relatively small patch, he can do well, and by spending his gains benefit the whole community. That this benefit is no small thing is shown by the fact that even in his present undeveloped state the native has spent over £100,000 in the last ten years on ploughs and trek gear alone.

The secondary object of these schools is to train up a class of native who will be able to assist the European farmer in the handling of the unskilled labour which, *faute de mieux*, he is obliged to employ.

Each pupil is expected to remain at the school for three or four years. In this time he should have reached Standard IV., and he should have a fair conversational knowledge of English. On the literary side he should be able to read and write in English and the vernacular. He should be able to keep simple accounts, milking and poultry records, yields from areas of land and similar statistics of use to his employer.

On the industrial side he should be a good rough carpenter, able to log and saw up native timber. He should have a good knowledge of roof construction and thatching, bricklaying and building in pisé or stone. He should be able to handle both transport and dairy cattle with intelligence. In the short time that the schools have been in existence, enough has been accomplished to prove that a number of natives with the necessary qualifications can be turned out each year. These natives should be the right-hand men of the farmers of this country. Those who elect to go back and live in the reserves should be examples to their people and assets to their country.

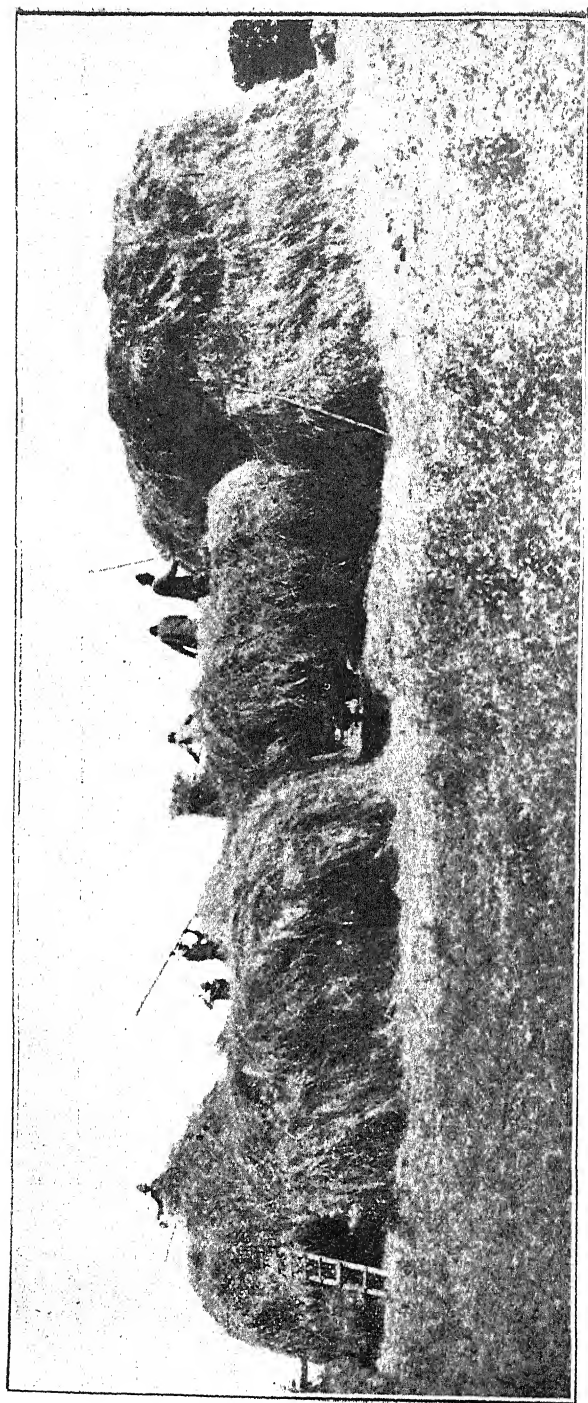
The photographs accompanying this article illustrate two activities of the schools on the industrial side, one in Mashonaland and one in Matabeleland.

The Gwaai drift was designed by Mr. A. C. Jennings, Irrigation Engineer, and was carried out by the pupils of the Matabeleland school.

The holding wall of the drift is exactly similar in construction to the stone and wire-net weir described on page 162 of the April issue of the *Journal*. The drift spans the wide sandy bed of the Gwaai River, and has opened up the important Gwaai reserve to motor and wagon traffic. It is proposed by the Automobile Association that the new motor road from Bulawayo to the Victoria Falls should cross the Gwaai at this point. The drift was just completed before this year's severe floods, and has withstood them successfully.







Stacking hay in Rhodesia.

## Hay-making in Rhodesia.

By C. MAINWARING, Agriculturist.

The success of the dairy industry and its future development in Rhodesia depends largely upon the attention which is given to the production of hay and forage crops for winter feed. Reflection on the loss due to the decrease of the milk supply, brought about by bare veld and the absence of succulent food, reveals the necessity of making and storing hay of good quality to tide over the six dry months of the year. Experience has shown that any season may bring a long spell of drought, resulting in scarcity of pasturage, and this, particularly during the winter, is the cause of heavy losses to dairymen and stock owners.

To prepare for such times of scarcity hay and forage crops must be harvested and stored. To make hay of good quality in Rhodesia is often a difficult matter; most of our principal natural grasses are at their best for this purpose during the month of February, while the heavy rains are usually not over until some time in March. Thus hay-making occurs at a time when weather conditions cannot always be relied upon. This difficulty can be practically overcome by grazing the veld intended for hay until the middle of December to retard the development of the grass, so that it will be at the correct stage for cutting after the late rains are over. The ordinary veld-hay grasses are not inclined to make much of an aftermath after cutting, therefore they should be allowed to stand until they are in the best condition, that is, when they are in flower.

With crops such as teff and Sudan grass there are several factors to be considered in determining the proper stage at which to cut for hay. If only one cutting is to be made, the greatest yield will be secured by allowing the crop to reach the full flowering stage. When two cuttings are to be made, the greatest yield is secured by cutting the first growth at a somewhat earlier stage and before the end of the rainy season.

The most abundant and at the same time probably the most useful native grass found growing over large areas of the Rhodesian veld is the rooi grass. This grass is a tufted perennial which covers many acres of plains and hillsides at varying altitudes, almost to the exclusion of other vegetation where the soil suits it, and is also found scattered among other grasses where the conditions are less favourable.

The stems are from three to four feet high, somewhat bare of leaves, and producing at the top rather large brown spikelets. The absence of the leaves on the stem is abundantly compensated by the leafy character of the shoots at the base, which yield excellent "green bottom." Like most African grasses, where veld burning has been constantly practised it grows in tufts or bunches. If cut at the proper time it makes an excellent hay, which is highly nutritious to stock.

Other good native perennial hay grasses are the several species of *Setaria*, commonly known as Rhodesian Timothy, and a few species of *Panicum* where found in sufficient quantity. The annual red-top grass found growing on old lands that have lain fallow for some time is valuable for hay. This grass, to get the best results, should be cut in the first stage of flowering—it then contains the largest percentage of nutriment. If left until it is in full bloom, the flower heads fall off in handling.

Sudan grass has been grown with marked success in Rhodesia. It is a very vigorous and drought-resistant annual; it succeeds best in seasons of moderate rainfall, and is chiefly grown for hay. It is of no advantage to use this grass for pasturage in the summer season when the veld feeding is good, and it is of no value for winter grazing, as it withers up after the first frost. The aftermath usually provides a useful bite in autumn prior to frost. The seed may be sown with the first rains, and if the season is favourable the crop can be mown twice. Sudan grass takes about three-and-a-half months to mature.

Good oat hay can be grown in abundance if the seed is sown on well-prepared soil during January or the beginning of February. Early varieties such as Kherson and Burt oats can be recommended, and should be planted at the rate of 60 to 70 lbs. per acre. The crop should be cut for hay when in full flower, or before if it is attacked by rust; frequently it produces a second growth which is useful for grazing.

There is also a number of introduced legumes, such as Kaffir, Velvet, *Dolichos* beans and Beggar weed, which, when cut green and made into hay, are nutritious and palatable, and readily digested by all classes of stock. Dairy cows especially respond to the nitrogenous matter contained in legumes by yielding liberal quantities of milk. Vigorous growing legumes, such as velvet beans, should be cut for hay as soon as the first pods are formed; at this stage of growth the vines are less wiry and all foliage is still green. Later than this period they are sometimes attacked by leaf spot or rust, and the plants grow woody. Because of their coarse habit of growth they are somewhat difficult to cure satisfactorily for hay. A good plan to follow in curing is to allow the plants to lie in wind-rows until well wilted (but not until the plants become brittle), and fork into cocks. Care should be taken to see that the cocks are so constructed as to admit of thorough ventilation in order that the hay may not mould and spoil. The dried hay should be handled as little as possible in curing and carting to the stack in order that the leaves may not be broken off and lost.

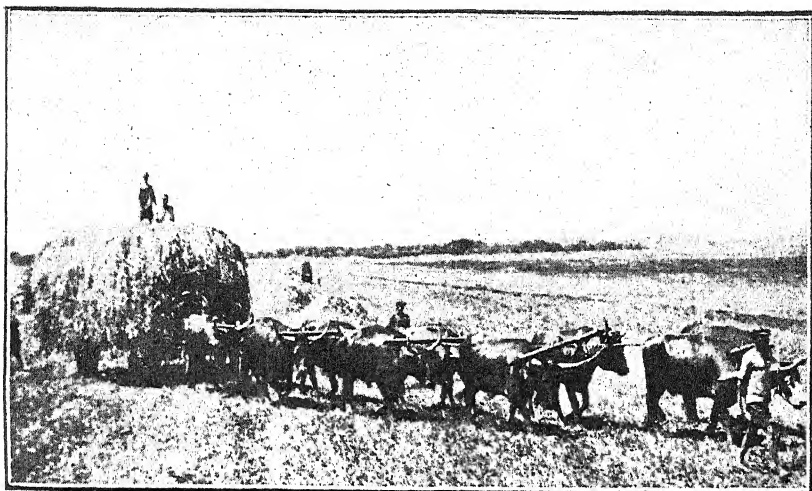


A good crop of Sudan grass at Experiment Station, Salisbury, 1923.

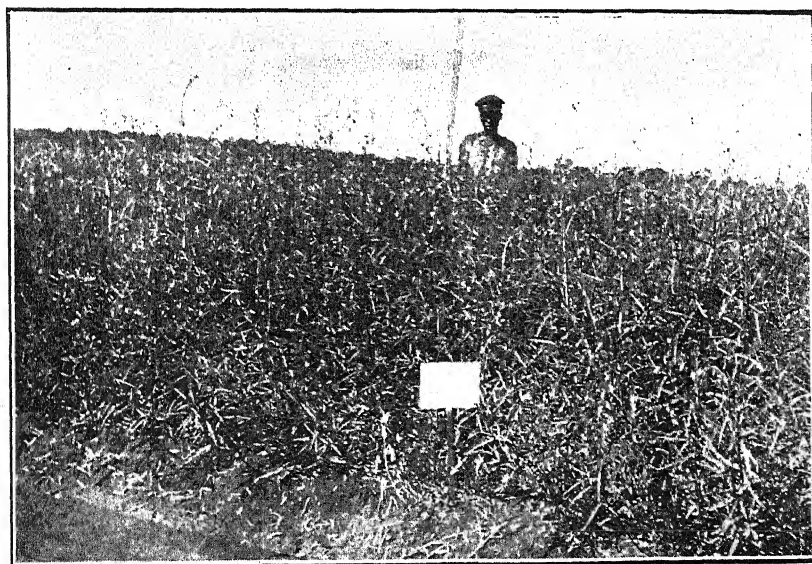


A nice crop of Teff grass, Experiment Station, Salisbury, 1923.





Riding hay at Gwebi Experiment Farm, March, 1923.



Fine Guinea grass (*Panicum* sp.), Experiment Station, Salisbury, 1923.





Given fine weather, hay-making is a simple process in Rhodesia. The only special implements required are a mower and a horse-rake. Natural veld that has not been burnt or grazed in previous years, and if intended for hay, will be greatly improved by burning off the old grass just before the rains, otherwise the fresh grass gets contaminated with old dead grass, which not only clogs and blunts the knife of the mower, but after being cut is raked up together with the new hay, thereby reducing the quality. If at the time of cutting there is abundance of sunshine, the rake should follow the mower, and the hay raked evenly into wind-rows, as grass lying in swaths is quickly bleached by the sun. If the crop is heavy the wind-rows may require turning over the same afternoon or the following morning after the dew is off. The main object to be secured in hay-making is to get the moisture in the grass evaporated as quickly as possible while still preserving its greenness.

For home consumption it is advisable to store the hay in stacks instead of baling it direct. A rectangular stack ten yards long by five yards wide carried up to nine or ten feet at the eaves and then "topped" with a sloping roof will be a convenient size and will hold about twenty tons of hay. About 15 lbs. of salt per wagon load sprinkled over while stacking will be found advantageous in rendering hay attractive to stock if it is not naturally so, but well-cured, aromatic hay derived from grass of good quality should not require this preservative and condiment.

# The Rearing of Bacon Pigs for Bacon Factory Purposes.

(Concluded.)

By T. HAMILTON, M.A., N.D.A., N.D.D., Dairy Expert.

## Factors which Influence Pig Raising.—*Economy of Production.*—

The pig, if suitably fed and housed, is perhaps the most profitable animal on the farm. If underfed, however, it is perhaps the least profitable and uneconomical. Reference to the table printed with this article will show that on an average a fattening pig requires only 5 lbs. of food (dry matter) to produce 1 lb. increase in live weight. This record is not equalled by any other fattening farm animal. Reference to the cattle-feeding experiments at Gwebi shows that it requires almost double this amount of feed to put on an increase of 1 lb. live weight. The price of pigs to-day is high, whilst the price of beef cattle is low, and therefore the value of the relative increase cannot well be compared; but nevertheless the fact remains that where land is expensive or is held in small holdings pig raising is regarded both as a popular and profitable branch of animal industry. Especially on our maize belts pigs should have a larger place than they hold in the scheme of mixed farming, which must be eventually developed in this country.

*Early Maturity Essential.*—In discussing breeds, it was pointed out how very essential it was to have early maturity in pig raising. The pig's life is very short, and to attain early maturity it should have no set-backs, otherwise the cost of the extra food necessary to prolong its life may make all the difference between a loss and a profit. This necessity for early maturity and for quick disposal is clearly shown in the following table, which is the average obtained by American investigators in experiments prolonged over a period of three years.

| Range of weight<br>of pig in lbs. | Average feed<br>(dry matter) per<br>day in lbs. | Lbs. weight<br>of food to<br>put on 1 lb.<br>live weight. |
|-----------------------------------|-------------------------------------------------|-----------------------------------------------------------|
| 15—50 ... ..                      | 2.23                                            | 2.93                                                      |
| 50—100 ... ..                     | 3.35                                            | 4.00                                                      |
| 100—150 ... ..                    | 4.79                                            | 4.37                                                      |
| 150—200 ... ..                    | 5.91                                            | 4.82                                                      |
| 200—250 ... ..                    | 6.57                                            | 4.98                                                      |
| 250—300 ... ..                    | 7.40                                            | 5.11                                                      |

Although early maturity from the farmer's standpoint is most desirable, yet the bacon curers do not like pigs the flesh of which is soft

and immature. It is perfectly feasible to turn out a pig of prime bacon weight in five-and-a-half months, but most authorities agree that the bacon pig between seven-and-a-half and nine months, weighing between 170 and 200 lbs., is the most suitable for high-class bacon production.

*The Use of Dairy Bye-products.*—There is no doubt but that milk has a wonderful effect upon a pig's growth. Especially at weaning time is separated milk of extreme value, as it is commonly noticed that at this time the weaner receives a check in growth which is accentuated unless separated milk is available. The supplementing of the mother's milk with easily digested meals and separated milk is necessary, because at this time the weaner is unable to assimilate much crude fibre. Later in the pig's life as much separated milk or butter milk as can be spared should be given. It should usually be given in thick but not fermented condition. It is unfortunately true that in most instances no attempt is made to keep clean the receptacle in which the separated milk is stored, and when dirty utensils are used, fermentation is set up, the sugar is turned into alcoholic compounds, and much of its food value wasted.

As we shall see, there are many farmers breeding bacon pigs without the use of milk, but there is reliable evidence that dairy-fed pork makes the best bacon. The combination of a food like maize (which is so rich in carbohydrates or starchy matter) with separated milk (which is so high in protein) gives us a mixture which is digestible, palatable and balanced.

Butter milk undiluted with washing water or brine is also an excellent feed, and, as it contains a fair proportion of fat, is especially useful during the fattening process.

Whey is also an excellent feed, but being deficient in protein must be fed mixed with meal, especially bean meal or barley meal. It should be fed fresh, and should not be allowed to become fermented. Whey in a fermented condition is almost useless as a pig feed; in fact, in such a state it not only has a tendency to scour, but is absolutely dangerous to feed to sows in pig.

Experiments conducted in Canada to compare the relative merits of the various dairy bye-products as food for pigs led to the following conclusions:—

“Separated milk gave the largest gain per pig as well as the most economical gain, whereas butter milk (undiluted) came so close to separated milk as to be regarded as practically equal in feeding value. Whey gave the best results when fed in quantities not exceeding 10 lbs. per pig per day. Excessive quantities of whey were found to be harmful.”

*The Necessity for Exercise.*—To the young growing animal exercise is essential. As has already been pointed out, it is perfectly feasible to force a pig on to bacon weight in five to six months, but any system of feeding which tends towards a too early laying on of fat and prevents the maximum growth of bone and muscle during the first four months of the pig's life, tends to the development of a shorter, thicker carcase than is required for the typical bacon pig. Exercise can only be given

by the provision of grazing. Not enough provision in this respect is made in this Territory. Too often pigs are turned out on to bare fallows or on to grazing grounds where their chief diet seems to be wind and dust. Green crops such as rape or kale, green barley or rye, can be sown for winter grazing, whilst for summer grazing velvet beans, sweet potatoes, ground nuts and good grass will be found excellent. Due care will have to be taken that the grazing ground is clean and free from the eggs of the tape worm which infests the intestines of so many of our natives. The loss caused by measles in pigs is exceptionally heavy throughout South Africa, and prevention being infinitely better than cure, every care must be exercised to keep grazing grounds clear.

*The Provision of Shade Essential.*—It should be remembered that Rhodesia lies entirely in the tropical zone. The actinic rays of the sun are extremely powerful, and, as has been pointed out by Dr. Hewetson, of Sinoia, they have a deterrent effect upon growth. It is the natural instinct of all animals, especially young animals, to seek shade during the heat of the day. A few grass shelters easily built and easily removed should be erected in the grazing grounds, and pigs will soon learn to use them of their own accord. The provision of a pig wallow is also a necessity, and a good supply of drinking water essential.

If it is impossible to provide shade in the grazing ground, better results will be obtained if a well-shaded pig paddock is fenced in with pig-netting. In this paddock racks can be erected, which should be kept filled from day to day with green stuff.

*Mineral Matter.*—Whilst our home-grown foodstuffs—maize, ground nuts, beans, peas, pumpkins, sweet potatoes, green barley, sunflower seeds, etc., supplemented if possible with dairy products such as skim milk—give enough protein, carbohydrates and fat to nourish the growing animal, yet for blood, bone and nerve production mineral matter is absolutely necessary. It is recommended that a mixture compounded of the following ingredients be placed in a trough to which the grazing or store pigs have ready access:—

- 40 lbs. wood charcoal.
- 20 lbs. sterilised bone meal.
- 20 lbs. wood ashes.
- 10 lbs. air-slaked lime.
- 5 lbs. sulphur.
- 5 lbs. coarse salt.

The mixture must, of course, be protected from the weather. Whilst salt in such proportion as is indicated is beneficial to pigs, yet much salt is poisonous, and such food as butter milk with which brine from the brine salting of butter has been mixed should never be given.

*Cooking Food for Pigs.*—Opinions differ as to the advisability of cooking food for pigs. Whilst some maintain that the cooking of the food makes it more digestible, others maintain that the resulting flesh and fat are soft and difficult to cure. The advantages which are gained from cooking are counterbalanced by the expense of fuel and labour, and where in such countries as Denmark fuel is dear, food as a rule is fed after being soaked in warm water. The only exception to this is

potatoes. In the absence of experiments, no hard and fast rule can be laid down. The boiling of food certainly has the effect of causing a more rapid gain than if raw or soaked food is given, but it is doubtful whether this gain sufficiently compensates the breeder for the extra labour and the fuel which cooking necessitates. In very cold weather it is advisable to give the food warm, but otherwise the soaking of grain and concentrates overnight or for at least twelve hours seems to give satisfactory results.

*The Need for Variety in Foodstuffs.*—It will be found that pigs thrive better and put on weight more quickly if the food is varied from time to time. The change in the diet should at all times be effected gradually. Any sudden break has the effect of putting a pig off its feed, with a consequent set-back and loss of weight.

*The Human Element in Pig Raising.*—The old saying, "It is the eye of the master that makes the horse fat," is true in any branch of animal industry. It is an unfortunate fact that the most stupid native on the farm is generally put on to feed and to look after the pigs, and in most cases the pigs show the effects of this policy. Bad luck is generally very much akin to bad management, and where "bad luck" seems to dog the unfortunate pig breeder's footsteps, one generally finds the housing of the pig deplorable and the food either lacking or given in such a haphazard way that the pig quickly becomes a source of loss instead of a source of profit.

*Regularity in Feeding.*—The most successful pig breeders and bacon producers known to the writer make an absolute rule that the fattening pigs must be fed at regular and stated intervals. Usually three meals per day will be found sufficient. If pigs are not allowed to run, the midday meal must consist of succulent matter, such as green lucerne, mangolds, pumpkins, sweet potatoes, etc., but when in the finishing pen hard grain should preferably be given and the succulent matter cut down to a minimum.

**Home-grown Feeds for Pigs.**—Mr. J. A. T. Walters, Agriculturist, contributes the following notes:—

The crops recommended to be grown in the provision of food for pigs may be classified as follows:—(1) grain foods, (2) succulent foods, (3) green fodder or pasture. The following remarks are in the nature of suggestions as to the methods of growing these crops more especially for pigs:—

1. *Grain Foods.*—The principal grains for pig feeding may be enumerated as follows:—Maize, kaffir corn, buckwheat, ropoko, inyouti (pearl millet), barley and rye, all rich in starch; peas, beans and cow-peas, rich in protein; ground nuts and soy beans, rich in protein and fat.

Of these, the principal, from the feeding point of view, is maize, and with this grain as the foundation of the diet, the other grains should be regarded as supplementary with a view to a properly balanced ration and an economical method of feeding. The leguminous grains were dealt with in an article on "Legumes for Southern Rhodesia" in the April issue of this *Journal*, from which it will be seen that all the

legumes referred to above, with the exception of soy bean, can be grown successfully in Southern Rhodesia. The methods of growing these crops need not be repeated here, and it only remains to emphasise the need of a certain proportion of leguminous grains in the diet to produce not only the most beneficial and rapid gains, but also to secure the most economical use of the more purely starch foods.

With regard to the remaining starch foods, such as buckwheat, ropoko and kaffir corn, these attain greater importance in the diet of the pig than in that of cattle, owing to the necessity in the production of bacon of providing a substitute for maize during the last feeding stages. For this purpose buckwheat is usually recommended in Southern Rhodesia, and, generally speaking, it has proved a fairly reliable crop over the greater part of the country. Buckwheat is perhaps the earliest maturing crop grown on a large scale in this country, maturing in less than three months. It may consequently be sown as late as the end of January, and fair crops are produced even later if rains permit. Seed may be sown either broadcasted or drilled in rows 15 inches apart. About 15 to 20 lbs. of seed per acre are required, and yields vary around 4 to 5 bags per acre. Very much higher yields are recorded when weather conditions are ideal, and it is a safe practice to make more than one sowing of this crop during the season. For the feeding of pigs, both stalks and grain may be used with advantage. Ropoko is not usually grown by Europeans, but the crop is reputed to do well on newly broken ground as a first crop. Kaffir corn has the merit of being comparatively drought-resistant, and of thriving under conditions that would be regarded as too unfavourable for maize, and the same remarks are true of pearl millet (inyouti). Neither of these crops is recommended for growth in the chief maize belts of Rhodesia.

Barley and rye are usually grown as winter crops either under irrigation or on the wet vleis which occur so freely throughout the country. These crops are usually sown broadcast at the rate of 40 to 60 lbs. per acre in a well prepared seed bed. The best time for sowing is April and May, the grain ripening in September and October. Here again the straw has considerable value in the feeding of animals.

From what has been written there is a considerable range of grain foods that can be utilised in the feeding of pigs, and sowings for this purpose will extend from November to May.

2. *Succulent Foods.*—Of succulent foodstuffs, as the term is understood in this country, the principal suitable for pigs are pumpkins, majorda melons and sweet potatoes. The first two provide a considerable amount of palatable succulent food at a minimum of cost in labour, and their value is greatly enhanced by the fact that storage during the winter months is possible, provided the fruit is handled with care and that bruising is avoided. Seed in both cases is sown in hills 8 feet apart each way, sufficient being sown to enable three or four plants to occupy each hill. Majorda melons do well in seasons of comparative dryness. Pumpkins, on the other hand, prefer a normal season of rainfall and respond to conditions of fertility. For pig feeding both should be grown each season. Pigs are the only animals that seem capable of digesting and assimilating the nutritious seeds of the majorda melon with great profit to themselves. Sweet potatoes thrive in almost every

class of soil, except heavy clay or wet soils. Their value as food and method of treatment have been noted in an article on the subject in the issue of the *Rhodesia Agricultural Journal* for August, 1922.

Mangels, sugar beet, turnips and swedes have not proved sufficiently reliable in Southern Rhodesia to be generally recommended. Under special conditions they frequently produce fair yields of roots, but their place is more profitably taken by the crops mentioned above. This is true of Jerusalem artichokes, which do well when planted in September under irrigation, but tubers usually fail to keep until November, when rains can be relied on to grow the crop. The practice of growing winter crops of kale, rape, drumhead cabbage and chard on wet vleis or under irrigation has proved successful, and is to be recommended. When kraal manuring is possible, improved yields can be expected in each case. Seed may be sown in drills 30 to 36 inches apart and the plants thinned out subsequently, or sowing may first be made in beds, transplanting later in lines as above.

3. *Green Fodder*.—The provision of pasture for pigs is both desirable and profitable, and the system employed resembles that in use for bigger animals. Where it can be grown, lucerne is, of course, the most desirable of all pastures, being evergreen, and responding to applications of water at all times of the year. Another legume, kudzu vine, is of great value for this purpose, but usually succumbs to frost during the winter months.

Winter crops of barley, barley wheat, oats or rye can be grown for this purpose, preferably at intervals from May to June, and if the pigs are allowed to graze on the lands during the growing period, the fertilising effect on such lands is considerable, and helps to maintain the productiveness of the soil. The value of green maize stalks in the young stages has not been sufficiently appreciated, and planting for this purpose, where water is available or vleis occur, can be started as soon as the frost is over. The late autumn and early spring growth of grasses like Napier fodder and Guinea grass helps to provide green food when the ordinary supplies are scarce.

From what has been written it is obvious that there need be no scarcity on the Rhodesian farm of the foods essential to the growth and well-being of the pig, even for special purposes. The need for alternatives to maize as a grain in the form of buckwheat, barley, etc., is beginning to be appreciated, and when this is supplemented by such leguminous grains as beans in any form, growth is rapid and economical. The essential succulents are comparatively easy of production and can be stored for the dry winter months, while in addition the provision of fodder for grazing is often possible in one form or another not only during the summer months, but whenever the farmer is able by means of his wet vleis or irrigation facilities to supply his land with the necessary moisture for plant growth.

**The Feeding of the Bacon Pig.**—In compounding rations for any farm animal, the following points should receive attention:—

- (a) Quantity or bulk.
- (b) Nutritive ratio.
- (c) Palatability.
- (d) Effect on the animal.
- (e) Cost.

(a) *Quantity or Bulk.*—If we refer to the table showing the average dry matter required to put on one pound of live weight, we find that it ranges, roughly speaking, between 4 to 6 lbs. per diem, depending on the size and weight of the pig. In order that we may have some fairly accurate knowledge of the bulk of food fed per day, the following table has been drawn up showing the dry matter in comparison with maize as a basis. Thus, 4.25 lbs. of boiled potatoes or 9 lbs. of pumpkins are equal in dry matter to one pound of maize.

|                                |       |
|--------------------------------|-------|
| Maize ... ..                   | 1.0   |
| Ground nuts (shelled) ... ..   | 0.8   |
| Beans ... ..                   | 0.9   |
| Sunflower seeds ... ..         | 0.9   |
| Oats ... ..                    | 1.05  |
| Barley ... ..                  | 1.05  |
| Potatoes (boiled) ... ..       | 4.25  |
| Sweet potatoes ... ..          | 3.25  |
| Pumpkins ... ..                | 9.00  |
| Majordas ... ..                | 15.00 |
| Mangels ... ..                 | 9.00  |
| Green lucerne ... ..           | 4.50  |
| Green barley ... ..            | 4.50  |
| Separated milk ... ..          | 6.50  |
| Butter milk (undiluted) ... .. | 6.50  |
| Whey ... ..                    | 13.00 |

(b) *Nutritive Ratio.*—It is obvious that in order to get a nutritive ratio of approximately 1 to 5 every ration must have a large proportion of its bulk composed of feed such as bean or pea meal, ground nuts, sunflower seed or, above all, separated or butter milk, all of which are rich in protein. Mathematical exactness is hardly necessary in the compounding of rations so long as the broad principles embodying the compounding of rations are observed.

(c) *Palatability.*—It is extremely important that the food be palatable, and that no violent or sudden changes in the rations be made. Some pigs dislike pea meal or bean meal intensely, but if these are introduced gradually the dislike can be overcome.

(d) *Effect on the Animal.*—It is conceivable that animals, like human beings, have their likes and dislikes. Where it is apparent that animals are not thriving, they should be isolated and their previous ration gradually changed. Of course, unthriftiness may be due to other causes besides feed, but if kept under observation in a separate pen the reason for their unthriftiness can usually be discovered.

(e) *Cost.*—This is a most important item, and unless the foods are home grown it often happens that the cost of the ration exceeds the value of the increase in weight. In a normal season, if the animal is grazed, the cost of feeding should be well within the mark at which it is possible to show a profit, especially as most of the feeds, such as maize, potatoes, ground nuts, etc., which are fed are below grade and have little or no commercial value. The only feeds it is sometimes advisable to buy are ground nut cake and bran or pollards. These, however, should be fed sparingly.



**Typical Rations.**—It would be impossible to give rations embodying every variety of foodstuff. The following are given as typifying the main principles on which rations are compounded. These rations in each instance are sufficient for a day's feed, and it is advised that one-third be given in the morning and two-thirds in the evening.

Young Pigs three to four months old.—

|                          |                   |
|--------------------------|-------------------|
| Maize ... ..             | $\frac{3}{4}$ lb. |
| Ground nuts ... ..       | $\frac{1}{2}$ „   |
| Potatoes (boiled) ... .. | 4 „               |
| Separated milk ... ..    | 5 „               |

together with grazing or green stuff in the middle of the day.

Alternative Ration.—

|                    |                 |
|--------------------|-----------------|
| Potatoes ... ..    | 4 lbs.          |
| Ground nuts ... .. | $\frac{3}{4}$ „ |
| Maize ... ..       | 1 „             |
| Majordas ... ..    | 5 „             |

If no grazing, majorda ration to be increased.

For Pigs four to six months old.—

|                               |                 |
|-------------------------------|-----------------|
| Crushed maize ... ..          | 2 lbs.          |
| Boiled potatoes ... ..        | 3 „             |
| Beans or peas (ground) ... .. | $\frac{3}{4}$ „ |
| Skim milk ... ..              | 5 „             |

Alternative Ration.—

|                               |                  |
|-------------------------------|------------------|
| Crushed sunflower seed ... .. | 1 lb.            |
| Crushed maize ... ..          | $2\frac{1}{2}$ „ |
| Ground nut cake ... ..        | $\frac{1}{2}$ „  |

In each case grazing or succulent matter, such as majordas, pumpkins, etc., to be fed in the middle of the day.

For Pigs six months and upwards (fattening).—

|                        |        |
|------------------------|--------|
| Skim milk ... ..       | 5 lbs. |
| Crushed maize ... ..   | 3 „    |
| Boiled potatoes ... .. | 3 „    |
| Crushed oats ... ..    | 1 „    |

Alternative Ration.—

|                               |        |
|-------------------------------|--------|
| Crushed maize ... ..          | 3 lbs. |
| Buckwheat ... ..              | 1 „    |
| Crushed oats ... ..           | 1 „    |
| Crushed sunflower seed ... .. | 1 „    |

Where pigs are not being fattened, the oats ration can be reduced to half and succulent matter substituted.

**The Preparation of Foodstuffs.**—One of the most useful machines on the farm for the preparation of feeds for pigs or dairy stock is the corn and cob mill worked by a horse gear. As much as eight to ten bags of feed can be put through in a day and a complete balanced ration prepared. This mill is especially useful in preparing a mixture compounded of the following:—

200 lbs. maize.  
200 lbs. beans.  
80 lbs. ground nuts.

If beans are scarce or too expensive, their place can be taken by sunflower seed or a greater proportion of ground nuts. In actual practice this mixture fed at the rate of 4 to 5 lbs. per day, together with separated milk, has caused an average increase in live weight of  $1\frac{1}{2}$  lbs. daily.

**Experience of Breeders of Bacon Pigs.**—Owing to there being no facilities at present for conducting Government experiments in this Territory, the experience of several authorities on pig breeding is quoted for general information.

Mr. D. C. Laver, the President of the Pig Breeders' Society of South Africa, a well-known breeder of pigs who incidentally generally manages to get top prices on the Johannesburg market, in his brochure, "How to produce the Bacon Pig," writes:—

"Before proceeding to the actual growing of the baconer, let us first consider the result. It has been fairly well established that the quickest growth and cheapest flesh are produced up to six months of age; from then on the cost to produce is greater, and the gain proportionately slower under equal conditions. Why is this?

"The reason is that the frame is under process of development to the greatest extent during that period, and the weight greater than of the actual flesh; and, further, that as the carcase weight increases a bigger quantity of food has to be consumed to maintain the same and make up for the wastage of the body, so that this has first to be supplied before additional flesh is added. Thus a pig of 140 lbs. will need about one-third more food than the pig of 100 lbs. to keep his body going, and so on; every increase of weight entails a greater consumption of food to produce a pound of flesh. Therefore, the farmer who sets out to produce his baconer of 160 lbs. to 200 lbs. at six months of age is going to make more profit than the man who turns his out at eight or nine months at the same weight, if the food costs the same and everything else is equal.

"But we have to produce the right bacon pig. Is this method going to do it? Under certain conditions it may, but under general conditions it will not, as to produce the pig at that age for the most part entails sty feeding from start to finish, and I contend that it is not possible as a commercial proposition to produce the right bacon pig under confinement. Witness the Tamworth, the best bred bacon pig known, so far as lean meat and fine texture of flesh are concerned—due to his activity and exercise. So, to produce the correct baconer, we must give the young pig exercise, and plenty of it, up to a point, to develop muscle and frame, to which later we will super-impose fat; further, it will be found on careful and skilful examination that the texture of the flesh of the six months' pig is not nearly so suitable for curing as his brother of a couple of months older; it is too infantile, and has not the quality desired.

"We will now assume we have secured the litter, and that they have been properly bred, fed and grown to the age of eight to ten weeks,

when we are taking them over to turn into the desired article. At this time they will weigh anything from 26 to 40, or even 50 lbs., but as a general run we find the eight weeks old weaner grown without milk running about 30 lbs. We now have to proceed on definite lines to attain our object, and we will therefore have made up our mind that he is to go to the factory at nine months of age, scaling 200 lbs. starved weight. Of course, there will be a little variation both in age and weight, but this is the standard before us.

"With this in view, we shall aim to make our pig develop frame and muscle until he is seven-and-a-half months old, and leave the remaining six weeks to finish him off. We will, at the same time, try to grow him at the minimum of cost. The first essential is to have him healthy, free from vermin inside and out; the former state will have been consequent upon his forbears, and the manner in which his foetal growth has been maintained, and also to a great extent upon the manner in which he has been cared for during suckling. If he has any lice or fleas, these must be got rid of either by dipping or rubbing with oil, while if there is any reason to suspect worms internally, these must also be got rid of by administering a vermifuge. . . .

"Our next care is to have provided a sufficient pasturage of the best succulent we can grow. . . . While lucerne is the best, kale runs it a good second, and spinach beet or Australian silver beet (as it is also called) is another good food, although this is more economical when cut and fed. Roots and tubers should be provided, and the arrangements must be so that an adequate supply will be available for the best part of, if not the whole time.

"The grain diet we must also provide for on the cheapest possible scale, but for the finishing period, cost must not be so carefully scrutinised. In any case it must be borne in mind that the test of cheapness is not in the intrinsic cost, but in the flesh it will produce for a given quantity.

"Having thus provided the requisite pasturage, grain, etc., we will allow him from now on (eight to ten weeks), until he is about four months old, somewhere about  $1\frac{1}{2}$  lbs. of grain a day, in addition to a free range on the pasture. The grain should be given mostly at night, say one-third of the quantity before turning on to the pasture in the morning, and the balance at night.

"If he weighed 30 lbs. at eight weeks he should weigh about 70 lbs. at four months, when the grain should be increased to about  $1\frac{3}{4}$  lbs. per day, at five months to 2 lbs., and at six months to  $2\frac{1}{2}$  lbs., which will be sufficient until he is seven-and-a-half months old. When it is said that the increase should be made at these ages it does not mean all at once, but gradually, and each increase to occupy, say, a fortnight. The breeder's judgment will have to be exercised here. During all this time piggie should be weighed occasionally to see whether he is responding as he ought, in order to bring him to 150 to 160 lbs. by the time he is seven-and-a-half months old, and as it is necessary for each farmer to have fairly accurate details of what is happening, even if the scale is not employed upon every pig, or every time, at any rate the first occasion, it is highly important that it should be done in order to

furnish a guide for subsequent operations. The cost of production should be ascertained at each stage.

"Having by these means brought our pig along to good growth in hard store condition at seven-and-a-half months, and then scaling somewhere about 150 to 160 lbs.—if this weight is attained sooner, then the finishing must be commenced earlier—he should be put into a suitable pen for finishing. The plan of operation is different now. Here is where the greatest possible return in flesh should be obtained for the food consumed, and to do this it is necessary to avoid undue expenditure of energy in every direction. The sty should be only large enough to accommodate the pigs without being cramped—warm in winter and cool in summer, plenty of trough room, so that each pig can eat in comfort without scrambling or fighting for a place.

"Sufficient food should be given at each meal to satisfy the animal, so that after it is consumed he will lie down and turn it into fat. The food should be softened so that it will be readily digested, and mineral food added to aid digestion.

"Care should be taken to ensure that the food is always soaked to the same degree of softness, and never allowed to soak long enough to ferment or germinate. In warm weather twelve hours will usually be sufficient, and with meals and finely crushed food six hours will generally suffice, while whole grain may require a little longer than twelve hours.

"Having quality of flesh to consider, it is necessary to provide foods of the right sort, and as a guide we should have procured for each pig about 120 lbs. each of mealies and barley or oats, and 25 to 30 lbs. beans or peas, all crushed for preference, but the barley or oats must be crushed, or the food value will be lost, particularly with oats; no amount of soaking will soften them sufficiently to ensure digestion.

"Having put the pigs into the pen, and secured the grain, we proceed to increase the supply of grain from  $2\frac{1}{2}$  lbs. to  $5\frac{1}{2}$  or 6 lbs. within the first fortnight by easy stages, continuing to feed green fodder in smaller quantities as the grain is increased, until at the end of a fortnight only a very little is being given at mid-day, and at the same time we will feed our pig three times a day instead of twice as before. The morning and mid-day meal should be about two-fifths of the grain content, and the remaining three-fifths fed at night, not forgetting the mineral, which, in addition to its other qualities, will cause the pig to drink a bigger quantity of water, and so assist in putting on more flesh in a shorter time. The barley or oats should be fed morning and mid-day and the mealies at night, to which should be added the beans or peas, at first in a small quantity, and increased very gradually until they form about one-third of the quantity by weight.

"If pollards and milk are available, then the former might with advantage take the place of the mealies, and a very much better finish will be obtained, while with milk both the quantity of food will be materially reduced and better results obtained.

"From the end of the second week the grain will need to be still further increased, while the green food will be cut right out—the same proportions being observed—to about 8 lbs. a day. As a matter of fact he should have all he will eat, providing that the excreta do not contain an undue proportion of undigested food. In such case the meals must be regulated to ensure the complete digestion, possibly two feeds a day, or a little less at each of the first two meals, or it may be as well to discontinue the bulk of whichever food shows in the evacuation. It may even be necessary in some cases to afford a little exercise; but if the cause can be ascertained, then a remedy can, of course, be devised. If the pig's destination involves a long rail journey, it will be well during the last ten days or so to bring him on to a harder diet, such as very slightly soaked whole mealies, which will tend to minimise the loss in weight.

"If the foregoing is taken as a guide, and the feeder in addition uses his powers of observation and discrimination, the animal should be ready to be sent off in six weeks at the outside, and if everything has been well done previously, possibly a good deal earlier, although the daily feed may have been larger than above recommended. It will generally be found that better flesh will result by the slower method than where forcing is carried to excess.

"It will, of course, be understood that results will vary considerably. Food, environment and the personality of the attendant are all contributory factors, as well as climate and, of course, the individuality of the animal, and the breeder will in each case find it necessary to alter all the factors as best he may to suit the circumstances. The feeder will need to know the condition to which his pig must be brought, as otherwise he may turn him out too fat or not fat enough, and so he must, if he has not that knowledge, take the first opportunity of seeing for himself exactly what is wanted by a trip to the factory or to some other farmer who understands his business, and see what finished condition actually is."

Mr. D. W. Bean, of Shamva, writes as follows:—

"I am breeding Large Black only, though I have tried both Black and Berkshire and the cross Berk-Large Black sows. I have given up Berk. entirely, for the following reasons:—Large Black pigs are more docile, more contented, better grazers and better 'doers' than the Berk. They grow quite as fast, or faster, than the cross, put on less fat, have deeper sides and length and thrive as well if not better. I cannot tell you what the opinion of the factories is, but they can give you this information. As far as I am concerned, I have always had a good report from the factory as to quality of my pigs.

"I have my pigs grazing in a large paddock, specially fenced with nine barb wires. In this paddock I grow crops which the pigs graze on—all sows and store pigs graze in the paddock until fit to finish off. The pigs to be 'finished' are put in a separate sty, where they get fed on the following:—Mealie meal, mealies (whole), buckwheat or a little dry barley; also green mealies on cob, when in season, or a few sweet potatoes or pumpkins or melons. Also they are not closely confined and are sent out grazing twice

a day, morning and evening, on rape or sweet potato tops, or cow peas. What I mean by grazing is they are turned out of the feeding sty into a patch of green food and allowed to walk about for an hour or so. I also have green barley for winter grazing. My reason for doing this is that I consider a certain amount of exercise a good thing to put on flesh between the fat, and give a streaky bacon, instead of cramming on fat only. I may be quite wrong, but it is only my idea, and I give it for what it is worth.

"I have never had milk of any sort at my disposal, yet I have competed successfully at all the recent Salisbury shows and have finished off a number of good quality baconers. I should like skim milk for my growing pigs, but have no hesitation in saying that milk is not an absolute necessity for the production of a really good class of pig. I find ground nuts a very helpful addition to the ration of the weaners. I find that by grazing, free range, and a bit of juggling with the foodstuffs at a farmer's disposal, waste, etc., milk is an item that need not be taken into serious consideration."

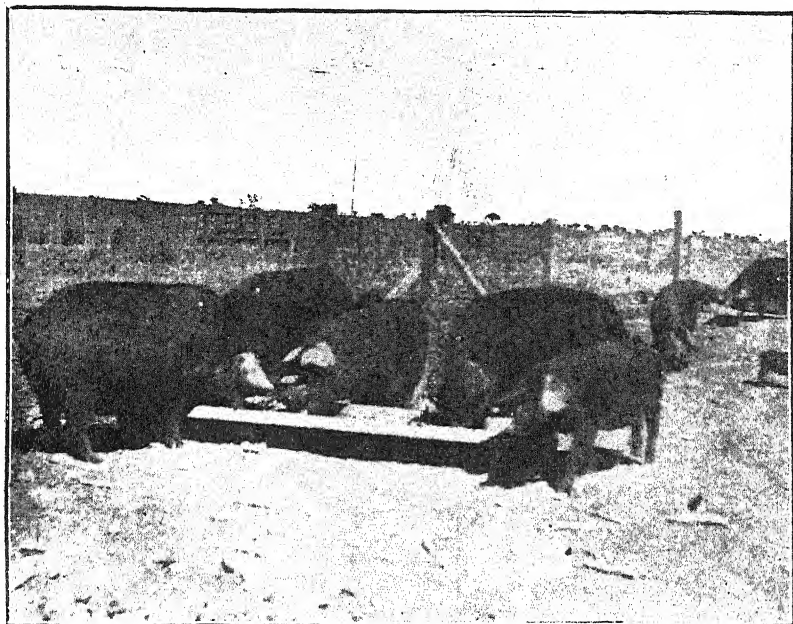
Mr. Lanigan O'Keefe, of Clonmore, Lochard, the well-known breeder of Large Black pigs, has kindly contributed the following notes:—

"I would first of all emphasise the utter uselessness of trying to make a silk purse out of the ear of a sow, *i.e.*, good bacon from a bad pig. The scrub takes longer to grow, therefore takes more food, and in the end the meat is of necessity coarse and hard.

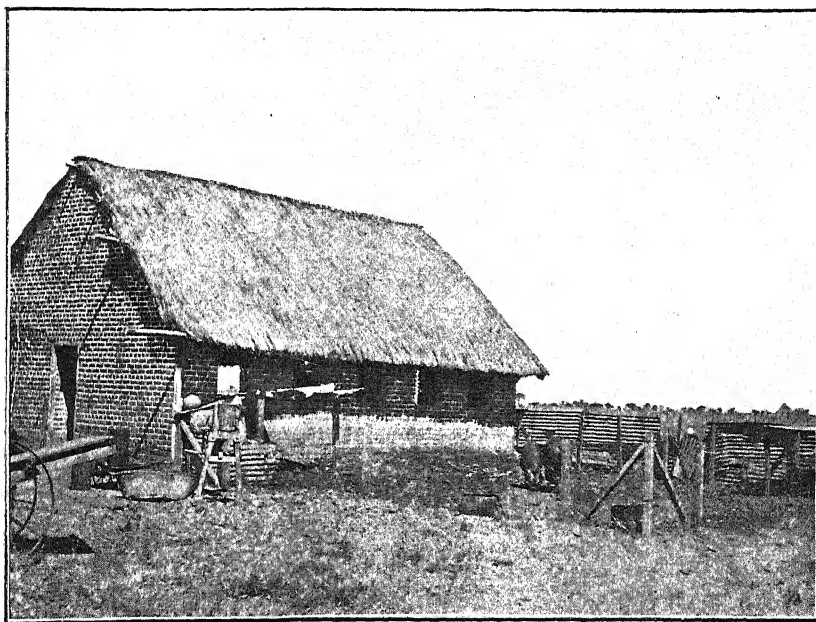
"The pigs bred here are pedigree Large Blacks. I quite believe that possibly a better bacon pig would be a Large Black-Berkshire or Tamworth cross, but for many reasons I prefer the Large Black; these are (a) their docility (which means easy fattening), (b) the ease with which they can be kept under paddock control (a most important consideration), (c) their prolificness, and the fact that they are invariably good mothers.

"The pigs here are run strictly on the open air system—there is not a pig sty on the farm. The paddocks vary in size in accordance as the pigs reach the finishing off stage, and each has access to fresh running water, in which all the pigs spend part of every day. The fencing consists of six wires close together and anchored in the ground every two yards. Such a fence I find completely able to control the Large Black, but it would not stand a hope with either Berkshires, Tamworths, or their crosses.

"I really think mealies of little use in the production of first-class bacon; it is all right for the breeding sows and boars, but for baconers either wheat or barley is required as the base of the ration. I have not, so far, owing to its cost, fed with barley, but I have obtained excellent results with a wheat meal manufactured by the Mark Harris Co. and sold by them at £8 a ton, Bulawayo. This I give the baconers in a ratio of two to one of mealie meal ( $\frac{2}{3}$  lb. for each month of age), added to which is skim milk *ad lib.*, and until the last month as much green food as they will eat, besides, of course, what they can pick up in the paddocks. In passing, I may perhaps say that without skim milk I should consider baconer raising an



Brood sows at Lochinvar, near Salisbury.



A useful type of farm piggery at Lochinvar, near Salisbury, with sties opening on to a run; note temporary shelters.





impossible proposition. During the last month the pigs, in addition to the grain ration, get velvet bean hay (soaked in water for twelve hours), but very little green stuff."

Mr. W. R. Fromburg, Kent Farm, P.O. Gwelo, writes:—

"First, in reply to your query as to the breed of pig I prefer, I have no hesitation in saying that the best results I have had have been from the Berkshire boar to Large Black sows with a strain of Tamworth in them. They make excellent mothers and produce progeny as near as can be to what the various bacon factories require, *i.e.*, good length and depth and not too coarse over the shoulders, and also give a nice thick side, and have the advantage over the Large Black-Berkshire cross of having a finer grain meat and a better percentage of lean to fat, and more evenly alternated.

"Secondly, as to whether I allow my pigs to run until ready for finishing off. I allow them plenty of exercise confined in camps, as I find young pigs grow much faster, and exercise is essential for the development of muscle, and assists me to produce at a minimum cost, which is, of course, my main object. I cannot put too much stress on the point of exercise up to the time the pigs are ready for finishing off.

"*Re* foodstuffs. I feed soaked mealies, crushed beans, lucerne, separated milk, pumpkins and majordas, and crushed oats during the finishing off stage, of course balancing the ration. I consider that a really high-class baconer cannot be grown successfully without separated or skimmed milk."

#### SUMMARY.

1. Pigs must be fed regularly.
2. Most authorities agree that exercise and grazing are essential to the growing pig.
3. Charcoal and mineral matter should always be available, but too much salt is poisonous.
4. Cooking food is advantageous if fuel and labour are cheap.
5. If for any reason cooking is impossible, meals and crushed corn should be soaked in cold water overnight.
6. For fattening pigs, water exceeding 3 lbs. to 1 lb. meal should not be used.
7. For growing pigs and sows with litters, more water can be used, and the food fed in a sloppy condition.
8. Green stuff is essential to the growing pig, and if in confinement, green stuff, pumpkins or majordas should form the basis of the mid-day meal.
9. Troughs must be kept clean and free from fermenting food.
10. Clean drinking water should always be provided.
11. Shelter and shade are most important.
12. Separated milk should usually be given in thick but not fermented condition. The receptacle containing the separated milk should be kept scrupulously clean.

## Ensilage.

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By J. A. T. WALTERS, B.A., Agriculturist.

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With the growth of the cattle industry in Rhodesia the necessity for providing winter fodder has become increasingly evident, and whereas some years ago such provision was confined to the cutting of a quantity of veld hay somewhat late in the season, the latest statistical returns show that there are now over 26,000 acres to fodder crops other than maize, besides over 12,000 acres to maize for ensilage, while the total number of silos—pit or stack—in the country is over 1,000. It is therefore obvious that the necessity for the provision of winter fodder is being realised, and with it the need for making *succulence* an essential feature of the feed for cattle during the dry season. Attempts to provide the necessary succulents have taken the form of growing mangels, pumpkins and melons, and of improving the veld by the promotion of grasses that keep green largely through the winter. No method, however, has been more satisfactory and economical for this purpose than the preparation of ensilage, for the reason that the material available for this purpose is so abundant in the summer months and the resultant foodstuff is so palatable and beneficial to stock.

The principal value of ensilage in the economy of farming lies in the fact that it represents an attempt to store summer feed for use during the winter months, and thus tends to even up the feeding conditions for the whole year. The long period of winter drought in Rhodesia would form a serious obstacle to stock rearing were such a provision not possible. Maize, grasses and legumes, when conserved in the silo, lose very little of their original succulence and palatability, and there is practically no loss in weight. Ensilage, therefore, provides an almost ideal method of storage.

Ensilage may be defined as green fodder which has been conserved in an air-tight pit or silo, or even in an open stack, and which has undergone a certain amount of fermentation in the course of storage. As is well known, heat is produced when green fodder is packed, and the whole art of ensilage-making may be said to consist in the regulation of this heat so as to prevent decomposition or rotting, but to allow a certain amount of fermentation to take place. This fermentation is responsible for the peculiar odour that ensilage possesses. Even in the making of ordinary hay a certain amount of fermentation is necessary, which is one of the reasons why it should be cut as early in the season as is possible, if it is to contain the full properties that characterise good hay.

The material for ensilage is abundant in Rhodesia, and as wet weather is no hindrance, it can be cut at any time it is ready. Ordinary veld grass may be used, while kaffir corn, Napier fodder, sunflowers, sweet potatoes, velvet beans, Kudzu vine, cowpeas, dhal tops, lucerne, Sudan or teff grass (in the green stage) are all excellent for the purpose. The best single material, however, is undoubtedly *maize*, and when cut at the proper time, it is unequalled for the purpose. Careful estimates show that the *best period at which to cut* any fodder destined for ensilage is that at which it contains approximately 75 per cent. water and 25 per cent. of dry matter. Analyses of the maize plant at different stages of its growth are shown in the following table, and the weights per acre have been adapted to average Rhodesian conditions:—

| Period of growth.           | Water<br>per acre. | Dry matter<br>per acre. | Percentage<br>of water. |
|-----------------------------|--------------------|-------------------------|-------------------------|
| Date of tasselling ...      | 10,000 lbs.        | 1,100 lbs.              | 90 per cent.            |
| 3 weeks later ...           | 17,500 „           | 2,900 „                 | 85 „                    |
| 5-6 weeks later ...         | 15,600 „           | 4,500 „                 | 77 „                    |
| 8-9 weeks later (crop ripe) | 12,500 „           | 5,000 „                 | 71 „                    |

From these figures it will be seen that the proper time for cutting maize for ensilage is about the *fifth or sixth week after flowering*. If the farmer therefore notes the period his ensilage mealies are in flower, he will know when to cut with the greatest advantage. If this date has not been noted, the right time can be told from the cobs, which should be well over the milky stage and showing the indentations plainly. The lowest leaves of the plant will also be turning brown at this period.

It is undoubtedly an advantage in the preparation of ensilage to utilise more than one crop, and if possible to include a leguminous crop, with a view to adjusting the *nutritive ratio* of the ensilage, or in other words to improve the “balance” of the material. The *velvet bean* is an excellent crop for this purpose, and can be grown either separately, or better still in among the maize intended for ensilage. Being a climber it will utilise the maize plants as a support, and as it is a slow grower it may be planted from 10 to 14 days before the maize, or the two may be planted at the same time. Plate I. shows a stand of maize and velvet beans grown under these conditions. Other legumes such as lucerne, cowpeas, peanut tops or dhal may be used, and are preferably cut in the flowering stage.

Another plant frequently recommended for inclusion in the constituents of the ensilage pit is the *sunflower*, partly on account of the oil content of its seeds and partly on account of the food value of its stems and leaves. The following analysis, showing the percentage of *digestible nutrients* in ensilage, gives an indication of its value:—

|                |     | Total<br>dry<br>substance. | Crude<br>protein. | Crude fibre<br>and carbo-<br>hydrates. | Ether<br>extract. | Ratio. |
|----------------|-----|----------------------------|-------------------|----------------------------------------|-------------------|--------|
|                |     | Per cent.                  | Per cent.         | Per cent.                              | Per cent.         |        |
| Sunflower      | ... | 21.4                       | 1.2               | 10.1                                   | 0.4               | 9.8    |
| Mature maize   | ... | 26.3                       | 1.1               | 15.0                                   | 0.7               | 15.1   |
| Immature maize | ... | 21.0                       | 1.0               | 11.4                                   | 0.4               | 12.3   |
| Velvet bean    | ... | 25.0                       | 3.8               | 18.9                                   | 0.5               | 7.8    |

The quantity recommended is one acre of sunflower for every four acres of maize, the sunflowers being sown separately.

Experiments conducted at the Agricultural Experiment Station, Salisbury, show that ensilage maize may be planted at the same distance as that generally used for grain. Plantings spaced in rows 30-36 inches apart by 15-18 inches gave an increase of over 10 per cent. in gross weight of fodder over the planting at 6 inches apart in the row, and the quality of the fodder was enhanced by the presence of a normal number of well-formed cobs, whereas with closer planting cobs were fewer and badly formed. The stalks were, however, rather coarse for fodder. When fine stalks are required and a fair development of cob, plantings at about 30 x 15 inches to 36 x 12 inches are recommended.

Heating and fermentation set in as soon as the material is cut and put in the pit, and the degree and nature of the fermentation depend upon the amount of heat evolved; the farmer therefore controls his ensilage by controlling the heat. Thus if the pit is filled slowly and the stuff is not well tramped great heat will be produced and decomposition or rotting may set in. This is due to the fact that the oxygen in the air produces combustion. If the material is packed tightly by tramping, and the pit filled a little more quickly, less heat will be evolved in proportion as the air is excluded. In this way fermentation can be controlled and decomposition prevented. The ideal *temperature* for ensilage-making ranges between 120 and 160 degrees (Fahrenheit). If the temperature exceeds 160 degrees it becomes blackened or burnt and may be useless. Within this range, however, a variety of qualities may be obtained, for the reason that different bacteria are promoted at the different temperatures. At the lower temperatures organisms producing lactic and acetic acids are active, resulting in *sour* ensilage; at the higher temperatures other bacteria form products resembling alcohol, which gives *sweet* ensilage its characteristic fruity or vinous smell. These different degrees may be stated as follows:—

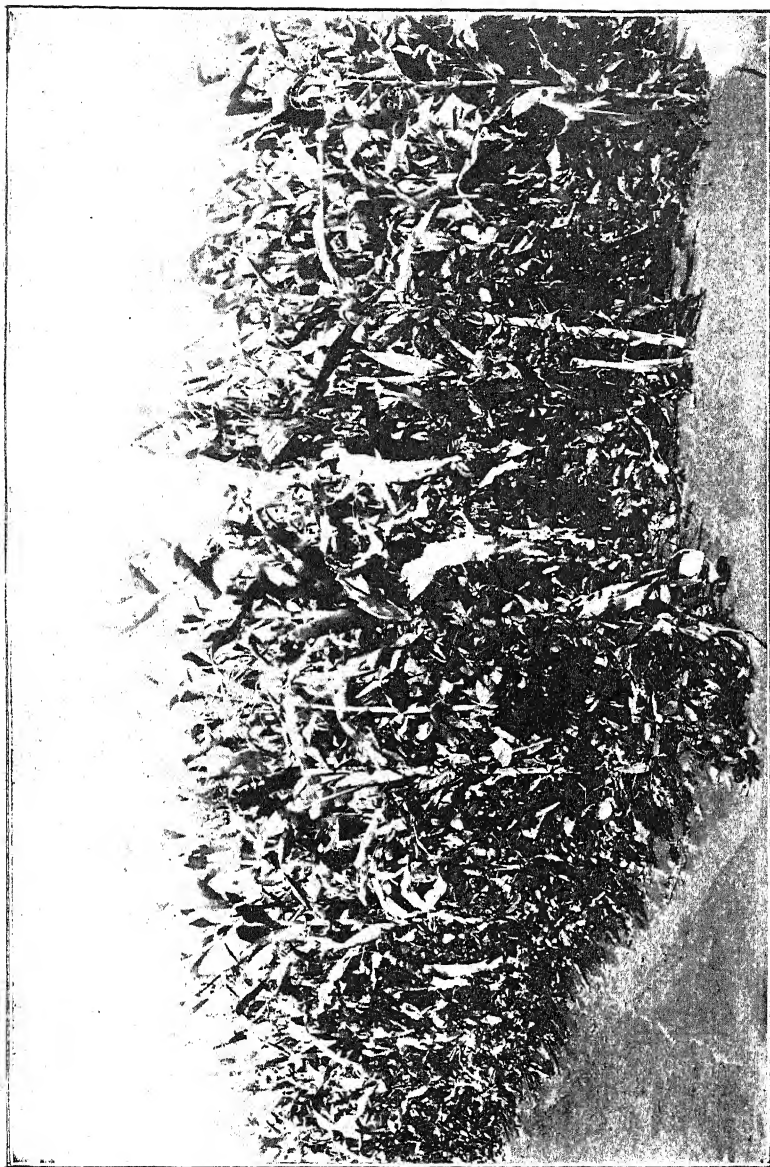
Under 120 degrees—sour ensilage.

120 degrees to 130 degrees—slightly acid.

130 degrees to 140 degrees—sweet green silage.

140 degrees to 160 degrees—sweet brown silage.

Over 160 degrees—burnt.



Maize and velvet beans grown together for silage.



The best ensilage is made at about 130 degrees, and is neither sweet nor sour, but it should be remembered that sour silage keeps better than sweet after the pit is opened. Ensilage should not be fed until fermentation has entirely closed, *i.e.*, not for about 6 to 8 weeks after the pit has been closed.

**Method of Filling.**—In filling the ensilage pit or silo, from four to six feet are filled in at a time and pressed down as firmly as possible. Care is required to ensure that the stuff at the sides is well tramped. The centre can be left to look after itself. The rise in temperature will occur almost immediately, and may be tested by plunging the hand into the heap or by using a thermometer, inserting it about two feet below the surface. In actual practice it may be assumed that if the fodder is cut at the right time and filled in at the rate of *four to six feet per day*, good ensilage will result. If it is thought that the temperature does not rise rapidly enough one day's heap should not be tramped until the following morning; this will promote a rapid rise in the heat. If the material used is too dry, this condition may be corrected by pouring water on the mass, otherwise there is danger of dry rot, which will seriously impair its quality. Whatever fodder is used it is improved by chaffing into pieces about one inch long before putting it into the pit. Chaffing helps it to pack better, and makes it easier to remove the ensilage when the pit is opened. Small quantities of salt may be added to the silage with advantage; Wrightson recommends the use of  $1\frac{1}{2}$  lbs. of salt for every ton of green material used, to be sprinkled over the ensilage as it is made. The pit should be filled about two or three feet above the surface to allow for the subsequent shrinkage, and covered with a foot or so of veld hay or straw; the whole should then be weighted down with a covering of several feet of earth. Any cracks that form during shrinkage should be immediately filled. Provided that the finished pit stands slightly above the level of the adjoining soil after shrinkage, and that water does not enter through the bottom or sides, the ensilage should keep good for several seasons.

From what has been said about the exclusion of air it will be obvious that a deep pit is preferable to a shallow one. The effect of depth on packing may be seen from the fact that the average weight of a *cubic foot* of ensilage to a depth of 15 feet is approximately 30 lbs., while to a depth of 30 feet it averages 40 lbs. In Rhodesia it is rare to find pits over 20 feet deep, and experience has shown that a depth of about 15 feet to 20 feet is most convenient for emptying. Where overhead silos are built they are frequently 50 feet high, and special arrangements in the form of continuous doors have to be provided for feeding out the stuff. For ordinary purposes in this country a pit 15 feet deep, 24 feet long and 15 feet broad will be found convenient for farm use. It will hold 67 tons of ensilage, which can be grown on nine acres, and will suffice to feed 36 animals for four months. A circular pit to hold the same amount would require to be 22 feet across, *i.e.* to have a radius of 11 feet. If very large quantities of ensilage are required, it is advisable to use a number of pits rather than one very large one.

**Pits, Silos and Stacks.**—In the above remarks reference has always been made to the pit. The pit is an ideal method of conserving ensilage

in this country, for the reason that our winters are dry and pits may be dug at any period after the heavy rains. It is also usual to feed the whole of the ensilage during the following winter. The pit is thus cheap, economical and effective. It is sometimes lined with brick or stone, but this is not necessary. If after a season or two the pit becomes unserviceable a new one is dug and the old one may be used to hold kraal manure or rubbish.

*Overhead silos* are the rule in America, and are more generally constructed of timber, less frequently of stone or other material. In the Union of South Africa silos are frequently found built of stone or brick, and constructed partly below ground and partly above. The *stack* is not often met with in South Africa. It is the simplest method of all of conserving ensilage, but is the most wasteful. This method consists of storing the green fodder above ground, as is done with hay, in the form of a stack, and its effectiveness lies in the fact that the mould which forms on the outside and penetrates to a depth of a foot or more constitutes an air-tight cover which prevents further decay. Chaffing is not practicable in this case, and whole maize stalks are generally used. It is necessary also to weight the stack well with stones or timber placed on top. Such stacks should be as big as is convenient in order to curtail waste, and when opened should be fed rapidly. They should also be erected some distance away from the homestead, as the odour is liable to be overpowering.

Analyses of ensilage will of course vary according to the material used. On an average, maize ensilage will contain about 75 per cent. water, 2 per cent. protein, 12 per cent. carbohydrates, 1 per cent. fat, 8 per cent. fibre and 2 per cent. ash. The addition of leguminous crops will improve the "balance" by increasing the total amount of protein present; or again the "balance" may be restored by including feeds like oil cake, velvet bean hay, lucerne, or beans in the daily ration of the animals. A point of greater interest in connection with silage is its *digestibility*. The total amount of digestible matter in any foodstuff is usually computed as the difference between the fodder fed and the solid excrements of the animal. There would seem to be no doubt that ensiling a crop maintains its digestibility as no other process of storage does. The annual report of the Ontario Experiment Station gives the result of an experiment to test the percentage of digestibility of maize ensilage as follows:—Protein 55 per cent., fat 61 per cent., carbohydrates 74 per cent. and crude fibre 74 per cent. In the "Feeding of Animals" (Jordan) the digestibility of dried maize fodder is given as 70.7 out of every 100 parts of organic matter, while ensilage made out of similar material gave an average of 73.6 digested. Maize stalks allowed to stand in the field after maturity show at the end of two months a loss of about one-half in the dry matter they contain, and more than one-half of the feeding value.

**Feeding of Ensilage.**—The rate at which ensilage can be most profitably fed to animals has been the subject of considerable experiment, and most experimentalists are agreed in placing the quantity at about 30 lbs. per day for dairy animals, a little more to beef animals, and from 15 lbs. to 20 lbs. a day for horses and mules. It can also be fed



with advantage to sheep, and even to poultry. It has a slightly laxative effect when fed in large quantities, but this is not apparent when used in addition to dry feed. Silage is said to taint milk, but this is due to the fact that milk very readily absorbs odours, and if the silage is fed after milking, and the milk is kept from coming into contact with the silage no danger need be apprehended. Its beneficial effect upon the milk supply is very striking, and trials have shown that only one feed—mangels—gives better results in this respect.

A matter of great importance to the farmer is an estimate of the acreage of fodder that has to be grown for ensilage in order to feed a given number of cattle for a given number of weeks. The following formulas will enable the farmer to gauge both the acreage he will require to grow and the size of the pit or silo he will require to construct:—

1. The quantity of ensilage recommended to be fed is about 30 lbs. per day per beast.

2. An acre of maize or maize and velvet beans yields about eight tons at the time of cutting. This will produce about seven tons of ensilage.

3. Ensilage shrinks to about five-sixths its original size in the course of a few weeks' time. In the following formulas and tables the size given for the pit has been increased to allow for this fact.

4. Multiply the number of cows by the number of weeks to be fed and divide by sixty-six. This will give the number of acres to be put under maize for ensilage. Example: 15 cows or oxen require to be provided with ensilage for 17 weeks,  $15 \times 17$  equals 255; divided by 66 equals  $3\frac{3}{4}$ , say 4 acres.

5. Size of pit. For every ton of ensilage allow 80 cubic feet. For every acre of ensilage maize allow 560 cubic feet.

6. Conversely, if the pit has been dug, it will store one ton of ensilage for every 80 cubic feet, and for every 560 cubic feet one acre of maize must be grown to fill it.

7. The following tables will save the farmer the trouble of working out formulas:—

| No. of cows to be fed for 4 months (17 weeks). | Quantity (in tons) of silage required. | Cubic content of silo or pit required. | Acreage of maize needed. |
|------------------------------------------------|----------------------------------------|----------------------------------------|--------------------------|
| 6                                              | 11 tons                                | 880 cubic feet                         | 1½ acres                 |
| 9                                              | 16½ "                                  | 1,320 "                                | 2½ "                     |
| 15                                             | 27 "                                   | 2,160 "                                | 4 "                      |
| 20                                             | 36 "                                   | 2,880 "                                | 5 "                      |
| 25                                             | 45 "                                   | 3,600 "                                | 6½ "                     |
| 32                                             | 58 "                                   | 4,640 "                                | 8½ "                     |
| 72                                             | 130 "                                  | 10,400 "                               | 19 "                     |
| 100                                            | 180 "                                  | 14,400 "                               | 26 "                     |

If the pit has been dug:—

| Size of pit.   | Quantity of silage it will hold. | Acreage of maize required to fill it. | No. of cattle it will feed for 1 month. |
|----------------|----------------------------------|---------------------------------------|-----------------------------------------|
| 400 cubic feet | 5 tons                           | $\frac{3}{4}$ acre                    | 11                                      |
| 700        "   | 9       "                        | $1\frac{1}{2}$ "                      | 20                                      |
| 1,000     "    | $12\frac{1}{2}$ "                | 2       "                             | 27                                      |
| 1,500     "    | 19       "                       | 3       "                             | 42                                      |
| 2,500     "    | 31       "                       | $4\frac{1}{2}$ "                      | 69                                      |
| 4,000     "    | 50       "                       | 7       "                             | 111                                     |
| 10,000    "    | 125      "                       | 18      "                             | 276                                     |

The above figures for the *acreage* necessary for the maintenance of a given number of cattle or to fill a certain size of pit will vary slightly according to locality. In districts like Mazoe or on rich lands generally, a slightly lower acreage will suffice; on sand veld or poor land the figures should be a little higher.

The complaint, once frequently made, that cattle refuse to eat ensilage is no longer heard now that ensilage is correctly made. Its regular use as an essential portion of the diet of live stock during our dry winter months cannot fail to be of the greatest value in maintaining the health of the herd or flock, and if in the preparation of this article an attempt is made to provide a well-balanced ration by the inclusion of legumes and other fodders, the effect on the milk supply of the dairy herd or on the gain in weight of the beef animals will amply repay the trouble which has been taken.

# The Poultry Industry.

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## PARASITES.

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By A. LITTLE, Poultry Expert.

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It is only comparatively recently that poultry diseases have attracted more than a passing notice in this country. Formerly little or nothing was known of them, except their existence as diseases of some sort; diagnosis of individual diseases was seldom if ever attempted, and treatment consisted of haphazard experiments and the use of all kinds of fanciful remedies. The poultry keeper either did not attempt to cure his birds at all, or when he did so adopted hit or miss, kill or cure methods.

This was unfortunately due to the fact that poultry was only considered as a subsidiary feature of mixed farming, and usually affording a little pin money only to the owner. A change has come over the scene, and it is now realised that poultry afford much more than pin money; in fact, that if properly treated a good income, and in many cases the wherewithal to tide over bad times. Not only have owners acquired more knowledge in the diagnosis and treatment of diseases of poultry, but they have (which is much more to the point) acquired knowledge of the prevention of diseases, and adopted proper hygienic methods in the housing, feeding and treatment of their birds with excellent results and increased profit to themselves.

Many and varied are the disorders and diseases to which fowls are subject, and if precautions are not taken to combat these, success is more difficult of achievement. The poultry keeper must continually be on the *qui vive* and adopt measures for the control of disease. Frequently the treatment may seem very drastic, but the more effective it is, the fewer are the outbreaks and the sooner is disease eradicated.

From a survey of the various disorders of poultry none appears more troublesome than the problem of infestations of poultry parasites. These cause general unthriftiness and unproductiveness among fowls, and although not always producing fatal results, cause the birds to be decidedly unprofitable. By their silent, secret work they prepare the way for debility and disease, resulting in the death of the birds.

Although poultry parasites are no more common in this country than in others, few poultry keepers realise the extent to which they

prevail upon fowls and infest the houses. Whenever fowls appear out of condition the first thing to ascertain is whether their bodies externally or internally are afflicted with any parasites.

Cleanliness of the fowls, their houses and surroundings should be strictly adhered to. Plenty of sunlight and fresh air should penetrate to all parts of the houses; the former is the best germicide we have. Dark, stuffy, ill-ventilated houses are the breeding grounds for poultry parasites, and yet how many of such do we still see in this country! It is no wonder the birds are out of condition and unprofitable. Periodical spraying of the interior of the houses and fittings should be carried out with one of the following mixtures:—

(1) Four tablespoonfuls of Kerol, Hycol, Izal or a similar disinfectant to 4 gallons of hot water.

(2) A ten per cent. solution of carbolic acid.

(3) One pound of hard soap cut into thin shavings and dissolved in one gallon of water. Heat gradually till it boils, then add one pint of carbolic acid; stir well till it becomes a creamy mass. Then for use take one pint of this and add ten pints of water, mix well, and spray.

(4) Instead of carbolic acid, paraffin can be used for the above.

(5) Creosote in a two per cent. solution.

Fumigating the houses is another method of destroying insects, but is not so beneficial or easy of manipulation as spraying. To eliminate insects on the bodies of the birds, dipping is infinitely the best method, although some have recourse to dusting with an insect powder. The best and simplest dip for this purpose is one to two tablespoonfuls of Kerol, Hycol, Izal or similar disinfectant mixed with 4 gallons of water and used at a temperature which can be comfortably borne by the hand.

The intention in this article is to deal only with those parasites which are most common in Rhodesia. The gape worm, which causes gapes in chickens, is unknown in this country, but in countries with a humid atmosphere, and where earth worms (which are the host of the gape worm) are plentiful, it is very common and causes great mortality; the same applies to some other poultry parasites.

**Internal Parasites.**—These are usually found in the intestinal tract.

*The Dispharagus spiralis.*—This is a round worm about  $\frac{1}{3}$  inch in length, found in the œsophagus.

*The Dispharagus nasutus.*—Also a round worm about  $\frac{1}{4}$  inch long, found in the gizzard. Sometimes hidden in the mucous membrane and sometimes only partly hidden, with one extremity hanging in the cavity of the gizzard.

*The Trichosoma contortum* is also a round worm from  $\frac{1}{2}$  to  $\frac{3}{4}$  inch long, found in the walls of the œsophagus; they are usually found in young Pekin ducks. The symptoms consist of arrest of growth, emaciation and weakness, with sometimes epileptiform attacks. In 8 to 10 days the lower part of the neck swells and death results.

*Heterakis perspicillum*.—This is the ordinary round worm which is very common, and found in the small intestine; it varies from 1.25 inch to 3 inches in length. It is round and cylindrical in shape, tapering at both ends, and is found not attached to the walls of the intestine, but lying free in its cavity in groups and bunches. Reproduction takes place by the development of embryos from eggs passed in the droppings; therefore it is obvious that all droppings should be treated with lime or burnt.

Symptoms of the presence of round worms are a ravenous appetite and great thirst. If the worms are numerous the appetite fails. Unthriftiness of the birds, poor laying, weakness and emaciation. Death may be caused by mechanical obstruction of a large mass of worms in the intestine, but this is not often the case; impaired health is usually only the outcome, and this is caused not only by the presence of these worms in the intestine, but also by the poisons they produce and which are absorbed by the birds.

*Tape Worms*.—These vary in length and breadth, and are elongated, flat and ribbon-shaped; they vary in length up to 4 to 5 inches. The smaller ones are formed in the duodenum and first portion of the small intestine; the larger ones in the ileum or lower end of the small intestine. Each worm has a head and neck and a number of segments. On the head is a set of hooks and four suckers; by means of these the worm attaches itself to the mucous membrane; the segments usually break away, leaving the head, which then develops more segments. Unless the head is detached, and this cannot be effected unless the worm is killed, no improvement in the condition of the bird can take place. The colour of the worm is creamish-white. The life history of the tape worm is interesting; it is similar to that in man. The worm produces segments which are filled with ripe eggs. These segments pass out in the droppings, and the eggs are thus set free. These find their way into damp places, where they are absorbed by insects or flies. The eggs, after reaching the intestinal tract of the insect or fly, are acted upon by the digestive juices; the shells are dissolved and the embryos set free. These burrow into the intestinal wall, and through it into the liver or other organ, and there rest awhile. This insect or fly is eaten by a fowl; the young worm then emerges from the organ and body of the insect in which it has been resting and attaches itself to the wall of the fowl's intestine, and there develops. It will therefore be readily understood from the above how infection takes place, especially if affected birds are numerous and the runs, etc., contaminated with droppings containing ripe eggs. Symptoms are much the same as those seen in round worm infestation. In addition, there is a yellowish-white diarrhoea, and segments may be found in the droppings. The birds become anæmic, the combs, face and wattle almost white or pale pink. The comb also will shrink in size. The feathers are dry and lose their glossy appearance, and may fall. The birds are mopy and their wings droop. Lameness and even partial paralysis may be present. It is as well to mention that the above are also symptoms of tuberculosis, and only a definite diagnosis can be obtained by killing a bird, slitting up the intestine and examining for tape worm. In tuberculosis in the liver and spleen,

and sometimes the intestines, will be seen small, irregular nodules, which are not present in cases of infestation with tape worms.

*Prevention.*—In this respect the same applies equally to round and tape worm infestation. The main method of prevention is similar to that which should be adopted in the case of all diseases, viz., by selecting birds of marked vigour and stamina as breeders, thus producing a strain of birds of high resistance to disease and other disorders and invasions of parasites. Prevention *must* be adopted to ensure any hope of success in the elimination of parasites. The birds should all be carefully examined, and all which show suspicious symptoms should be isolated. The droppings of these should be either burned or treated with lime or sulphuric acid. Where infestation with worms is experienced, all the birds should be moved on to fresh ground at least every two years, and the runs dug up and saturated with a strong solution of unslaked lime, to which is added 5 per cent. of Kerol, Hycol, Izal or similar disinfectant. Spray the house and fixtures with a solution of 50 lbs. of lime to about 50 gallons of water. The floors of the house should be covered with a mixture of lime and sand in the proportion of 1 part of lime to 10 parts of sand. All food and water utensils should be cleaned daily with a solution of some disinfectant and water.

*Medicinal Treatment.*—The following can be used generally for round and tape worms:—

(1) Two grains of santonine one hour before the first meal; follow three hours later with a dose of 20 grains of Epsom salts in a tablespoonful of water.

(2) Three teaspoonfuls of oil of turpentine, followed as above with Epsom salts.

(3) One dram of powdered malefern or 30 drops of liquid extract of malefern before food morning and evening.

(4) Five grains of powdered areca nut, followed by Epsom salts.

(5) To prevent or expel worms it is advisable to feed occasionally chopped onions or garlic.

When giving turpentine it is advisable to mix it with equal parts of sweet oil; the mixture should then be well shaken, and before administering it the bird should be fasted for 24 hours, and a dose of Epsom salts given during this period. It is always as well to carry out the treatment twice, with an interval of three weeks between each.

(6) One teaspoonful of pomegranate root bark in the food to every fifty birds is an excellent remedy for tape worms.

Poultry keepers who suspect that their poultry are infested with round or tape worms are invited to send one or two to the Department of Agriculture for examination and *post-mortem*. These should be addressed as follows: "The Poultry Expert, Department of Agriculture, Salisbury. Fowls for examination. Urgent." They should be forwarded by passenger train, carriage paid.

**External Parasites.**—*The Fowl Tic.*—We have in Rhodesia one external poultry parasite, and one which is a most serious pest, viz., the Fowl Tic (*Argus persicus*), which is frequently erroneously called the Tampan. This tic is also met with in India, Australia, New Zealand and parts of America, but is non-existent in temperate and cold climates. As full particulars of it were given in *The Rhodesia Agricultural Journal* for December, 1920, there is no necessity to repeat them here.

*Lice, Fleas and Mites.*—These are found in practically every locality where poultry are kept. When present in considerable numbers they reduce egg production and hinder the growth and lower the quality of the flesh of all fowls. There are many kinds of these insects; some cause itching of the skin, resulting in discomfort to the fowls, and so loss of productivity; others injure the feathers; others burrow under the scales of the shanks and toes; others gnaw the skin and tissues; and others again suck the blood. Whenever fowls appear to be out of condition, the first thing is to ascertain whether their bodies are afflicted with any of these insects.

Cleanliness of the fowls and their surroundings is the first and most important consideration. Light, airy houses tend to greatly reduce infestation. Spraying the houses and surroundings as previously recommended should be periodically carried out. Opportunity of dusting themselves in soft earth should be given to the birds, and the earth slightly moistened with a weak solution of some disinfectant. Chickens should be dusted frequently with some insect powder. The birds should also be dipped periodically in a solution of Kerol, Izal or similar disinfectant and warm water as recommended previously.

*The Red Mite (Dermanyssus galline).*—This insect is only of a red colour when engorged with blood; when not engorged they are yellowish, whitish or almost transparent. They hide by day in cracks and crevices. They often cluster in colonies, and where they congregate for a considerable time mealy dust and webs may usually be found. They feed on the bodies of the birds at night or when they are sitting or laying. If on the boards of the house, perches or nests are seen specks of black and white (which is the excrement), red mites are present near by in the cracks. If present in considerable numbers, the birds will become droopy, weak, and their combs and wattles will be pale. Sitting hens will desert their nests or be found dead on the nest. All the birds subject to the attacks of these insects are so weakened as to become susceptible to various diseases. The complete life cycle of the red mite from the egg to an adult is seven days only; it will then live for four or five months, even if the fowls have been taken out of the house.

The roosts should be taken out of the house, also all unnecessary boards and boxes, and the house well sprayed, care being taken that the disinfectant be applied from all angles and thoroughly forced into cracks. The floor too should be treated in the same way. The solution should be applied as hot as possible. No matter what disinfectant is used, the success depends chiefly upon the thoroughness with which

the spraying is carried out. All perches, nests, etc., should be treated in the same way.

*The Leg Scabies Mite (Sarcoptes mutans).*—This insect, which causes *scaly leg*, is a very common one in this country and in the majority of others. This mite, although usually attacking the shanks and feet, sometimes also attacks the comb and neck. It burrows under the scales, causing the shanks to assume an uneven appearance and to become crusted with mealy substance. Intense itching accompanies this, the legs and feet often become badly distorted, and the birds are sometimes unable to walk. It can therefore be fully realised that such a condition undermines the health and vigour of the bird and causes unproductiveness. As the mites are transferred from one bird to another, scaly leg fowls should be treated promptly. The perches should be periodically rubbed over with a rag dipped in paraffin, and some Kerol, Hycol, etc., poured into the sockets. The legs and feet should be soaked in or scrubbed with warm soap-suds, and then greased with sulphur and lard, or lard and Kerol, or lard and 6 per cent. carbolic acid or carbolised vaseline. The treatment should be carried out daily till the birds are cured. Many birds put on shows lose points for this condition.

*Depluming Mite (Sarcoptes salvis).*—This burrows into the skin near the base of the feathers and produces intense itching, causing the fowls to pull their feathers until they are almost naked. The head and neck are the parts usually affected. Repeated applications of sulphur ointment will effect a cure.

*Lice.*—These are frequently found in some form or other in the bodies of chickens and adult fowls. Unlike the mites, these remain on the fowl constantly. All have a flattened form and are fitted with various spines and peculiarly modified legs. They do not suck the blood, but subsist on the waste matters of the skin and feathers. Their presence is, however, very irritable to the bird, and for this reason it is not so productive or healthy as it would be if free from them.

Symptoms of lice infestation in chickens are droopiness, lowered wings and ruffled feathers, often diarrhoea and death. Adult birds may not show any ill effects, but the egg yield decreases, unfertile eggs result, there is loss of weight, and also tendency (due to lowered vitality) to other diseases. We have body lice, head lice and feather lice on fowls, according to the parts in which each are found.

*The Head Louse (Lipeurus heterographus)* is usually found on the head and neck of chickens. It is not very common in Rhodesia, but it is prevalent in Great Britain, America and Australia, and is responsible for the deaths of many chickens in these countries. It is of a darkish grey colour, about  $1/10$  inch in length, and is found on the top and back of the head. It passes readily from one chicken to another, and from the hen to her brood. Application of blue mercurial ointment is recommended for the elimination of this louse.

*The Body Louse (Menopon biseriabum).*—This is the insect often seen when the feathers on a fowl are raised, running quickly about the body; it is usually found on the breast, wings and below the vent. It is large, robust and of a straw colour. The eggs are seen in clusters



at the base of the feathers. They hatch in about a week after being laid, and the adult stage is reached in about 18 days from the time of laying the eggs. The best method of getting rid of these body lice is by dipping the fowl.

Other lice are (1) *The Shaft Louse*, which is small, light yellow and is found on the shafts of the feathers. (2) *The Wing Louse*, which is dark grey, with an elongated body, and found usually on the wing feathers. Its movement is rather slow. (3) *The Fluff Louse*, which is small, broad and translucent. As its name implies, it is found on the fluff. (4) *The Large Hen Louse*, which is large, nearly  $\frac{1}{8}$  inch in length, and very broad in proportion. In colour it is smoky grey, in some cases almost black, and with darker patches on the sides of the abdomen. The treatment for the elimination of the above lice is also dipping.

*Fleas*.—Of these we have the ordinary bird flea, which is usually found on the neck or beneath the breast. It is also found moving about freely in the house. It is generally introduced in litter, and increases very rapidly. Thorough spraying will keep fleas in check; dusting powdered, well-slaked lime will assist in destroying them.

*Sand Fleas* are so called because they lay their eggs below the surface of dry, pulverised earth or sand, or between the interstices of a brick floor or cracks in cement, etc.; in fact, anywhere where dust or dry sand is present. They are by far the worst and most prevalent of the external parasites in this country, and during the hot weather are a serious pest to poultry. They are small, dark-brown insects, and are found in clusters on the head and neck parts of the bird, and attached tightly to the skin. They multiply very rapidly, and unless thorough and constant measures are taken for their extermination, quickly affect the whole flock of birds.

A hard, smooth floor without crack or crevice in the poultry house is the best preventative. This should be sprayed frequently with a disinfectant and hot water, and the ground surrounding the house should be treated in like manner. The heads of the birds should be periodically (during the hot season, when these insects are most numerous) rubbed with carbolised vaseline. Thorough and constant spraying as above of houses and surroundings is prescribed, also a free use of powdered slaked lime. Those insects found on the heads of the birds should be rubbed with blue mercurial ointment, but the treating and extermination of these is of no avail unless the floor of the house and the surroundings are also treated as advised, for no sooner are the fleas attached to the heads of the birds destroyed than others are continually hatched below the surface of the sand or dust, and rise to take their place. The poultry keeper should be always on the *qui vive* during the hot weather for these pests, and on their appearance adopt immediate and drastic measures for their destruction. Constant and thorough war must be waged against them if success is to be attained.

If the fowls and their surroundings are thoroughly clean and free from parasites, the poultry keeper should do his utmost to keep them so by not allowing other poultry to come in contact with them. Never

bring any other fowls on to the place which have not been thoroughly examined for insects. See that any new birds have been well dipped twice before their introduction; never allow second-hand crates on the place without their being well disinfected beforehand. The possibility too of parasites being carried from infested quarters on boots, clothing, wagons, etc., should be realised, and also their conveyance by wild birds.

Above all should the birds be kept in vigorous condition, for diseased birds or those with malformations of any kind readily fall a prey to parasites. If every poultry keeper would adopt the above precautions, and would constantly wage war on poultry parasites, we should have a far more vigorous and healthier stock of poultry in Rhodesia, and the production both of birds and eggs would more rapidly increase.

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## SOUTHERN RHODESIA.

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# Report of the Chief Veterinary Surgeon

### FOR THE YEAR 1922.

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At the beginning of the year under review the position in regard to infective diseases of stock was most satisfactory, and with the exception of a serious and unexpected outbreak of Coast Fever in the Charter district and two outbreaks of the same disease in Melssetter district, this was well maintained throughout. Fortunately the spread of infection in both districts has been limited so far to reasonable proportions, but the restrictions necessary to accomplish this result have caused considerable hardships to the cattle owners concerned through their being unable to market cattle and the stoppage of transport by oxen. This is unavoidable, as our past experience shows that the suspension of all cattle movements in a large area, to begin with, is one of the most effective methods of preventing the spread of infection. Of the other diseases which exist in the Territory, contagious abortion of

cattle was most in evidence, and no doubt will continue to be a cause of loss until some satisfactory method of prevention by vaccination is discovered.

Schedules are attached showing the Coast Fever infected areas, with mortality, and the numbers of animals imported and exported.

*African Coast Fever.*—Thirteen centres were carried forward from the previous year as actively infected, viz., two in the Melsetter district, one in the Mazoe district and ten in the Matobo district. No case of disease had occurred at any of these centres since May, 1921, and this immunity from infection continuing, all were released from quarantine after the expiration of the usual period from the date of the last case of disease.

For nearly twelve months from 1st June, 1921, not a single case of Coast Fever was recorded anywhere in the Territory, and great hopes were entertained that the eradication of all infection was in sight, but these were dissipated in May by outbreaks in the Charter and Melsetter districts. In the latter case the re-appearance of the disease, whilst most disappointing, was not altogether a surprise, as active infection had existed in the district twelve months previously; but Charter district had been clean for upwards of twenty years, and the nearest infection was about 150 miles away in Melsetter district. If the disease had been carried from Melsetter to Charter by cattle, its appearance somewhere *en route* might have been expected with some degree of certainty, but as far as we know all the cattle in the intervening country are still healthy. It is possible, of course, that whilst in the incubative stage an animal might travel more than 150 miles before dropping infected ticks, but in this case it is highly improbable, as there is no community of interest in the areas involved by the disease in both districts which would be likely to lead to movements of cattle for any purpose, and it is extremely unlikely that a beast would stray this distance in a short period, especially across the Sabi River in the summer season, when the water level is high. Further, it can be stated with confidence that no cattle have been moved from or strayed from any infected area in the Melsetter district, and the possibility of cattle straying across such areas and then travelling 150 miles is very remote. The only other possible source of infection which can be suggested is cattle purchased at certain farms in the Bulalima-Mangwe district which were no great distance from the heavy infection which existed in the Matopos during 1920 and the early part of 1921. These cattle arrived at the Wiltshire Estate, the first seat of infection in the district, more than twelve months before the disease was discovered there; the farms from which they came and the roads along which they were driven to the railway have never had Coast Fever infection, and are still free from it. It is clear, therefore, that if these cattle were responsible for carrying the disease to the Charter district they must have come in contact with infection after leaving the Bulalima-Mangwe district, either in the railway trucks or on the road from Umvuma to Enkeldoorn, but there is no evidence whatever of the existence of any such infection. This is by no means the first instance

where Coast Fever has suddenly appeared in a clean district far removed from infection and no evidence forthcoming as to where it came from or how it was carried. Such occurrences are most unsatisfactory, but on the other hand it is perhaps a matter for congratulation that they are not more frequent.

In the Charter district the disease first appeared on the Wiltshire Estate, an area of over a quarter of a million acres, carrying upwards of 7,000 head of cattle, exclusive of several hundred belonging to natives, the latter being located on the north-eastern section of the estate on an area specially set apart for them. Early in May a mortality considerably above the average occurred, which, on investigation by the District Veterinary Surgeon, Gwelo, and subsequent microscopical examinations, proved to be due to Coast Fever. Prior to this the mortality had not been above that which is to be expected from ordinary causes, including gall-sickness and quarter-evil, both of which were present from time to time; indeed, the highest recorded in any month from January, 1921, was 23 head in February, 1922. It soon became evident that a very heavy infection existed, and it was upwards of three months before the mortality was reduced to reasonable proportions. Within a few days of the occurrence of the Wiltshire outbreak, infection was found on the farm Swartfontein, adjoining Enkeldoorn commonage, and the farm Mooifontein, ten miles east of Umvuma, in the Chilimanzi district. In June it was found on the farm Chipisa, and in August on the Enkeldoorn commonage and a kraal on the north-western section of the Sabi reserve, all in the Charter district. In each case the infection was directly attributable to cattle which had been removed from the Wiltshire Estate shortly before the discovery of the disease there.

In the Melsetter district the owner of the farm Randfontein reported the death of a heifer on the 5th May from Coast Fever, and sent the spleen and kidneys to the Cattle Inspector for his examination. Smears taken from these organs and examined microscopically proved the correctness of the diagnosis by the owner, whose prompt action in the matter is highly appreciated, as it undoubtedly prevented a serious outbreak in the vicinity. Infection proved to be at a minimum, as only eight cases occurred out of 257 head, which were not removed from the infected veld. During the same month the disease was discovered on the farm Merino, about 30 miles distant from Randfontein, and subsequently five other farms in the vicinity became involved. No connection can be traced between these two centres, nor can the source of infection be traced in either case, but it must have resulted from infection at other centres in the district during the previous year; by what means, however, cannot be explained.

*Anthrax.*—This disease re-appeared on two farms in the Shamva section of the Mazoe district, and a fresh centre occurred in the Mtoko native reserve, but within the area where infection is known to exist. The animals affected were cattle, and the total mortality was 23 head. The herds involved were treated with vaccine supplied by the Pasteur Laboratories, Paris, and the results have been most satisfactory. It

may be noted that so far there has been no case of anthrax amongst sheep and goats in the Territory.

Compared with most other cattle countries, the position here in regard to anthrax is highly satisfactory. The areas affected are localised, and when infection does manifest itself it is speedily overcome by vaccination. It is most important that every effort should be made to maintain this position, as it is not unlikely that in the near future restrictions will be placed by importing countries on hides, skins, wool, etc., from areas where anthrax is prevalent.

*Contagious Abortion of Cattle.*—This disease was demonstrated at 59 centres where its existence had not been known previously. This shows a slight improvement over 1921, when 94 fresh centres were reported. There was a considerable demand for the special vaccine prepared at the Veterinary Research Laboratory, Salisbury, and to assist farmers in the depressed state of the cattle market, the price was reduced by half. Early in the year 500 heifers on one of the large ranches were treated with a live vaccine before being put to service, and in November 3,500 were similarly treated. The results in the former case should be available at an early date; in the latter, they cannot be until the conclusion of the next calving season. We are much obliged to the Director of Veterinary Research, Pretoria, for his assistance in supplying such a large quantity of vaccine.

*Tuberculosis.*—The existence of this disease was discovered on a farm in the Nyamandhlovu district amongst some bulls and heifers which had been imported during the previous year from the Orange Free State. One of the bulls, which had been in good health apparently, died suddenly, and *post mortem* examination revealed lesions of tuberculosis, and microscopic examinations were confirmatory. The other animals were tested with tuberculin; four re-acted and were destroyed, and in each case there was evidence of tuberculosis on *post mortem* examination.

At the Shangani Estate the herd in which tuberculosis was found in 1920 was tested twice, with the result that 23 animals re-acted; some of these were destroyed and others sent to the camp in which the previous re-actors are segregated.

In the Salisbury district a young pure-bred Shorthorn bull was found to be affected and was destroyed. The animals in contact were tested, with negative results.

*Quarter-Feil.*—This disease was practically unknown in Southern Rhodesia until November, 1916, when, after a heavy rainfall which marked the breaking up of a long spell of drought, it suddenly appeared in the Bulalima-Mangwe district in a virulent form, affecting cattle of all ages, and causing a very heavy mortality. It spread gradually from district to district, and within three years there was scarcely an area in the Territory which had not suffered from it and with the same experience, viz., a heavy initial mortality, including animals of all ages. Fortunately the first experience was the worst, and now with the regular inoculation of young stock the losses are negligible. The vaccines now

used are aggressin and Leclainche and Vallee's liquid preparation, both of which continue to give the greatest satisfaction.

*Stiff-Sickness (Stijfziekte) of Cattle.*—The following description by District Veterinary Surgeon Hamilton of an outbreak of a form of "Stijfziekte" is the first record of any such affection in Southern Rhodesia:—

"The term 'Stijfziekte' is used generally in South Africa to describe certain affections in cattle in which certain interference with the locomotory apparatus is the primary symptom. In Southern Rhodesia the term 'stiff-sickness' is used to describe one form of 'stijfziekte' only; this is what is also known as 'three-day sickness,' and is now almost looked upon as a benign disease, as in most cases the affected animal, after three days' illness, characterised by inability to use its limbs, becomes all right again, and as the treatment consists of leaving the animal alone, this particular disease, after it is once seen, does not cause alarm. I have lately observed another form of 'stiff-sickness' which in many respects resembles the genuine South African 'stijfziekte,' and possibly this form has not been recorded before in Southern Rhodesia. The particulars of this outbreak are as follows:—The disease occurred on a farm about 12 miles from Gwelo in February, 1922. The owner told me that many of his breeding cows were showing a great craving for bones, and were continually coming to the homestead looking for bones. A few weeks later many of these cows began to go very lame and have difficulty in travelling. Altogether about 50 animals were affected. All those affected were breeding cows, and mostly those with calves. Oxen and young stock remained on the same ground and were unaffected. The main symptom was difficulty in locomotion; the affected animal moved with a peculiar gait not unlike laminitis, and had the spine somewhat arched. These symptoms pointed to an inflammatory condition of the bones below the knee and hock; there was, however, no swelling of the joints as is seen in the most severe form of this disease, nor was there evidence of grooving and upturning of the hoofs, which is a symptom of the 'stijfziekte,' caused by eating the plant known as 'Crotalaria Burkeania.' All the animals, naturally on account of pain when walking, lay about a great deal, and on account of not grazing sufficiently, fell away considerably in condition; so much so that three cows were destroyed simply because of their excessive weakness. Curiously enough, the milk did not seem to vary much in quantity or quality, as the calves of affected mothers maintained their condition. These symptoms, after persisting for about three months, began to gradually subside, and apparently all the remaining affected animals are going to recover. No treatment was attempted, except giving a little food to some of the animals not able to forage for themselves. It is difficult to point to a direct cause, but the symptoms shown, and only the cows with or carrying calves being affected, seem to suggest that possibly the disease has something to do with an absence of phosphorus in the natural food. This theory is further strengthened by the knowledge that these cattle are grazing on new veld which is very rough and coarse and has not been previously grazed. This fact leads me to hope that as the veld becomes grazed down the new veld will contain a greater phosphoric content, and in time provide the required amount of

phosphorus. All the neighbouring farms are well stocked and have never recorded the sickness.

"I am indebted for considerable information about this disease to an article on 'Facts and Theories about Stijfziekte and Lamziekte,' by Sir Arnold Theiler, published in the second report of the Director of Veterinary Research, Pretoria, 1912."

*Veld Poisoning.*—The following observations by District Veterinary Surgeon Park Hamilton on the subject of veld poisoning in cattle are interesting:—

"Under this name stock owners report deaths when they are unable to diagnose anything exact. Undoubtedly, however, there are cases of herbal poisoning, and possibly these last few months, owing to cattle being forced in some cases to eat anything green, there have been more deaths than usual. I have during the year had two instances of true herbal poisoning; in each case it was confined to cattle grazing in certain places on the farm. I was unable to trace the actual poison, and that is the most unsatisfactory part of this illness.

"The first cases were at Mr. Coles' farms, Gwelo. He reported losing one or two animals which did not respond to any gall-sickness treatment, and *post-mortem* showed acute inflammation of abomasum and small intestine. Having read somewhere that iron and copper salts are incompatible with many vegetable alkaloids, I gave  $\frac{1}{2}$  oz. cupri sulph. in a quart of water as the initial treatment in such cases, following up with linseed tea and demulcents. This treatment has apparently given satisfactory results. The other case was at the Shangani Estate in a paddock where young bulls were grazing. Several of these bulls were taken ill, and two died before my arrival. I found three bulls sick; all seemed to be suffering from acute abdominal pain, grunting, and occasionally straining, but not passing anything. None of these animals had a high temperature, nor had any of those of Mr. Coles. The aforementioned treatment was carried out.

"The question of temperature is an important one in the diagnosis of veld poisoning, as the other symptoms shown frequently would lead one to suspect gall-sickness or other microbic diseases, but in those cases of veld poisoning the elevation in temperature was small, .102 to .103, and sometimes instead of an elevation the temperature was sub-normal. In acorn poisoning in England I have noted the absence of a high temperature, but certain poisons, according to Lander, do cause a high temperature; bracken poisoning, for example."

*Foot Rot in Calves.*—In the Victoria district a serious outbreak of a form of foot rot in a large troop of calves was investigated by District Veterinary Surgeon Hooper Sharpe. Practically all the animals became infected, and the mortality was 25 per cent. The Director of Veterinary Research reported as follows on specimens submitted for his examination:—

"Examination of infected feet submitted showed a septic arthritis and coronitis and with sloughing of the hoof. From the lesions the bacillus necrophorus, an unidentified bacillus (a facultative anaerobe),

and streptococcus were recovered and cultivated. Primary cultures proved deadly to rabbits in 12 hours. Sub-cutaneous inoculation of a rabbit with a piece of necrotic tissue gave rise to an abscess at the seat of inoculation, yielding pus containing the same three organisms. The inoculation of material infective to rabbits into a calf failed to produce any appreciable effect."

*Myiasis (Screw Worm of Cattle).*—This affection was prevalent during the summer months in the Mazoe district and certain areas in the Midlands and Matabeleland, but generally much less was heard of it than in any year since its first appearance. As infestation frequently occurs in the wounds caused by the bont-legged tick, five-day dipping for a short period resulted in the reduction of these ticks to a minimum, with a corresponding decrease in the number of cases of screw worm.

*Sweating Sickness of Calves.*—During the rains a few cases of this disease were reported from the Salisbury district and some districts in Matabeleland. The total mortality was negligible.

*Ephemeral Fever (Three-day Sickness of Cattle).*—Very few cases were reported during the year.

*Trypanosomiasis.*—A slight mortality in cattle occurred in the Darwin, Lomagundi, Hartley, Gwelo, Melsetter and Wankie districts.

*John's Disease.*—This is a specific chronic enteritis of cattle, and had not been observed previously in the Territory. One case occurred, the animal affected being a pure-bred Shorthorn bull.

*Cattle Cleansing Ordinance.*—During the year 176 dipping tanks were erected, bringing the total number to 2,275. Owing to the prolonged drought the dipping interval was extended to fourteen days in various areas, in others dipping had to be suspended entirely because of the failure of the water supply and the impoverished condition of the cattle.

*Horse-Sickness.*—The mortality reported was 104 horses and 5 mules, as compared with a total of 186 during the previous year.

*Glanders.*—No case of glanders occurred, and no re-action to the mallein test which is applied to all horses, mules and donkeys on importation.

*Swine Fever.*—One outbreak occurred in the Bulawayo district during the month of March. The whole of three litters of young pigs died, but up to the end of the year there had been no case of illness amongst the adult pigs or young ones born subsequent to the cessation of the mortality. The existence of the specific infection was demonstrated by biological tests.



## AFRICAN COAST FEVER.

Infected Areas and Mortality, 1922.

| District.  | Farm.                   | No. of cattle. | May. | June. | July. | August. | September. | October. | November. | December. | Total. |
|------------|-------------------------|----------------|------|-------|-------|---------|------------|----------|-----------|-----------|--------|
|            | <i>Fresh Outbreaks—</i> |                |      |       |       |         |            |          |           |           |        |
| Melsetter  | Randfontein             | 257            | 4    | 2     | ...   | 2       | ...        | ...      | ...       | ...       | 8      |
|            | Merino-Sable Home       | 260            | 30   | ...   | ...   | ...     | 15         | 27       | 6         | ...       | 78     |
|            | Smaldeel & Bamboo Creek | 276            | 44   | ...   | ...   | ...     | ...        | ...      | 1         | ...       | 45     |
|            | Umzelezwe               | 277            | ...  | ...   | 4     | ...     | ...        | ...      | ...       | ...       | 4      |
|            | Elandsberg              | 214            | ...  | ...   | ...   | ...     | 9          | ...      | ...       | ...       | 9      |
| Charter    | Wiltshire Estate        | 5,810          | 380  | 388   | 180   | 79      | 22         | 2        | ...       | ...       | 1,051  |
|            | Swartfontein            | 188            | 15   | 46    | 24    | 4       | 6          | ...      | 1         | ...       | 96     |
|            | Chipisa                 | 74             | ...  | 1     | 26    | 8       | 4          | ...      | ...       | ...       | 39     |
|            | Sabi Reserve            | 22             | ...  | ...   | ...   | 1       | ...        | ...      | ...       | ...       | 1      |
|            | Enkeldoorn Commonage    | 608            | ...  | ...   | ...   | 1       | ...        | ...      | ...       | ...       | 1      |
| Chilimanzi | Mooifontein             | 355            | 1    | 2     | 1     | ...     | 1          | 4        | 1         | ...       | 10     |
| Total      |                         | ...            | ...  | ...   | ...   | ...     | ...        | ...      | ...       | ...       | 1,342  |

## IMPORTATION OF STOCK.

|                                   | Bulls. | Heifers. | Sheep and goats. | Horses. | Mules. | Donkeys. | Pigs. |
|-----------------------------------|--------|----------|------------------|---------|--------|----------|-------|
| From the United Kingdom           | 12     | 9        | ...              | ...     | ...    | ...      | ...   |
| From the Union of South Africa    | 418    | 272      | 27,732           | 561     | 264    | 521      | 7     |
| From the United States of America | 1      | ...      | ...              | ...     | ...    | ...      | ...   |

## EXPORTATIONS.

|           | Union of South Africa. |           |       |                  |         |        | Northern Rhodesia. |       |            |           |       |       |
|-----------|------------------------|-----------|-------|------------------|---------|--------|--------------------|-------|------------|-----------|-------|-------|
|           | Cattle.                |           |       | Sheep and goats. | Horses. | Mules. | Donkeys.           | Pigs. | Cattle.    |           |       | Pigs. |
|           | Slaughter.             | Breeding. | Oxen. |                  |         |        |                    |       | Slaughter. | Breeding. | Oxen. |       |
| 1922.     |                        |           |       |                  |         |        |                    |       |            |           |       |       |
| January   | 110                    | ...       | ...   | ...              | 2       | ...    | 12                 | 156   | ...        | ...       | ...   | 41    |
| February  | 242                    | 420       | ...   | ...              | ...     | ...    | ...                | 154   | ...        | ...       | ...   | 6     |
| March     | 566                    | 50        | ...   | ...              | 1       | ...    | ...                | 276   | ...        | ...       | ...   | ...   |
| April     | 1,497                  | 120       | ...   | ...              | ...     | ...    | ...                | 207   | ...        | ...       | ...   | 1     |
| May       | 1,503                  | ...       | ...   | ...              | 1       | 2      | ...                | 248   | ...        | ...       | ...   | 46    |
| June      | 1,705                  | 359       | ...   | ...              | ...     | 5      | ...                | 86    | ...        | ...       | ...   | 4     |
| July      | 2,427                  | ...       | ...   | ...              | ...     | ...    | ...                | 3     | ...        | ...       | ...   | ...   |
| August    | 2,666                  | 7         | ...   | ...              | 2       | ...    | ...                | 97    | ...        | 61        | ...   | ...   |
| September | 1,750                  | 431       | ...   | ...              | ...     | ...    | ...                | ...   | ...        | ...       | ...   | ...   |
| October   | 1,248                  | 197       | ...   | ...              | 3       | ...    | ...                | 60    | ...        | ...       | ...   | ...   |
| November  | 1,958                  | 279       | ...   | ...              | 1       | ...    | ...                | ...   | ...        | ...       | ...   | ...   |
| December  | 1,044                  | 773       | ...   | ...              | ...     | ...    | ...                | 40    | ...        | ...       | ...   | ...   |
|           | 16,716                 | 2,636     | ...   | ...              | 10      | 4      | 12                 | 1,327 | ...        | 61        | ...   | 98    |

## EXPORTATIONS.

| 1922.     | Congo.     |           |       |                  |         |        | Portuguese East Africa. |       |            |           |       |                  |         |        |          |       |     |
|-----------|------------|-----------|-------|------------------|---------|--------|-------------------------|-------|------------|-----------|-------|------------------|---------|--------|----------|-------|-----|
|           | Cattle.    |           |       | Sheep and goats. | Horses. | Mules. | Donkeys.                | Pigs. | Cattle.    |           |       | Sheep and goats. | Horses. | Mules. | Donkeys. | Pigs. |     |
|           | Slaughter. | Breeding. | Oxen. |                  |         |        |                         |       | Slaughter. | Breeding. | Oxen. |                  |         |        |          |       |     |
| January   | ...        | ...       | ...   | 65               | ...     | ...    | ...                     | 65    | 84         | ...       | ...   | ...              | ...     | ...    | ...      | ...   | ... |
| February  | ...        | 15        | ...   | 105              | ...     | ...    | 16                      | 61    | 117        | ...       | ...   | ...              | ...     | ...    | ...      | ...   | ... |
| March     | ...        | 18        | ...   | ...              | ...     | ...    | 28                      | 70    | 77         | 450       | ...   | 30               | 2       | ...    | ...      | ...   | ... |
| April     | ...        | 42        | ...   | ...              | ...     | ...    | ...                     | 45    | 25         | 152       | ...   | ...              | ...     | ...    | ...      | ...   | ... |
| May       | ...        | 10        | ...   | ...              | ...     | ...    | 16                      | 45    | ...        | 4         | ...   | ...              | ...     | ...    | ...      | ...   | ... |
| June      | ...        | ...       | ...   | ...              | ...     | ...    | ...                     | 45    | ...        | ...       | ...   | ...              | ...     | ...    | ...      | ...   | ... |
| July      | ...        | 30        | ...   | ...              | 4       | 8      | ...                     | ...   | ...        | 84        | ...   | ...              | ...     | ...    | ...      | ...   | ... |
| August    | ...        | 324       | ...   | 65               | ...     | ...    | ...                     | ...   | ...        | 5         | ...   | ...              | ...     | ...    | ...      | ...   | ... |
| September | ...        | 216       | ...   | ...              | ...     | ...    | ...                     | ...   | ...        | 6         | ...   | ...              | ...     | ...    | ...      | ...   | ... |
| October   | ...        | 815       | ...   | 65               | ...     | ...    | ...                     | ...   | ...        | ...       | ...   | ...              | ...     | ...    | ...      | ...   | ... |
| November  | ...        | 181       | ...   | 105              | ...     | ...    | ...                     | 20    | ...        | ...       | ...   | 65               | ...     | ...    | ...      | ...   | ... |
| December  | ...        | 1,016     | ...   | 80               | ...     | ...    | ...                     | ...   | ...        | 221       | ...   | 130              | 3       | ...    | ...      | ...   | ... |
|           | 2,552      | 568       | ...   | 485              | 4       | 24     | 60                      | 351   | 303        | 922       | 180   | 275              | 10      | 5      | 102      | 96    |     |

SOUTHERN RHODESIA.

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# Report of the Director of Veterinary Research

FOR THE YEAR 1922.

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*Routine Work.*—During the early part of the year the work was limited to the routine duties of the office and laboratory, research work being held over pending the removal from the old establishment to the new veterinary research station, which it was hoped would be available in February. Unfortunately the laboratory was not ready for occupation until June, and the stables are not even yet completed. When the removal had been effected, the organisation of the new station involved considerable additional work, and in the absence of professional assistance little time was available for research. Investigations which had been commenced had to be abandoned and much necessary work could not be undertaken. This is greatly to be regretted. As pointed out by the Director of Veterinary Education and Research for the Union, "Restriction of research work is not actually in the economical interests of the country." For example, had it been possible to continue the inoculation of horses, which for several years has proved so successful, many thousands of pounds and much disappointment and inconvenience might have been saved to horse owners during the present horse-sickness season.

The following table shows the number of preparations received at the laboratory for diagnosis, and the principal diseases detected:—

PREPARATIONS RECEIVED FOR DIAGNOSIS  
DURING THE YEAR 1922.

| Month.    | Total. | African<br>Coast Fever. | Infectious<br>abortion. | Quarter evil. | Anthrax. | Trypanosomiasis. | Tuberculosis. | Anaplasmosis. | Piroplasmosis. | Spirochaetosis. |
|-----------|--------|-------------------------|-------------------------|---------------|----------|------------------|---------------|---------------|----------------|-----------------|
| January   | 196    | ...                     | 13                      | 11            | 1        | ...              | ...           | 12            | 8              | ...             |
| February  | 206    | ...                     | 9                       | 19            | 1        | 3                | ...           | 16            | 1              | 3               |
| March     | 145    | ...                     | 13                      | 16            | 2        | ...              | ...           | 6             | ...            | ...             |
| April     | 161    | ...                     | 11                      | 15            | ...      | 9                | ...           | 1             | ...            | ...             |
| May       | 252    | 16                      | 31                      | 16            | ...      | ...              | ...           | 2             | 1              | ...             |
| June      | 372    | ...                     | 56                      | 13            | ...      | 1                | ...           | 1             | 1              | ...             |
| July      | 142    | 2                       | 16                      | 10            | ...      | ...              | 2             | 5             | ...            | ...             |
| August    | 200    | ...                     | 26                      | 8             | ...      | 1                | ...           | 4             | ...            | ...             |
| September | 205    | 9                       | 21                      | 13            | 5        | 4                | ...           | 2             | 1              | ...             |
| October   | 223    | 12                      | 10                      | 1             | ...      | 4                | ...           | 2             | ...            | ...             |
| November  | 356    | 3                       | 16                      | 3             | 2        | ...              | ...           | 2             | 4              | ...             |
| December  | 146    | 3                       | 8                       | 3             | 1        | 8                | ...           | 3             | 1              | ...             |
|           | 2,604  | 45                      | 230                     | 128           | 12       | 30               | 2             | 56            | 17             | 3               |

PREPARATIONS RECEIVED FOR DIAGNOSIS  
DURING THE YEAR 1921.

|  |       |    |     |     |   |    |   |    |     |     |
|--|-------|----|-----|-----|---|----|---|----|-----|-----|
|  | 2,815 | 42 | 346 | 115 | 4 | 23 | 1 | 45 | ... | ... |
|--|-------|----|-----|-----|---|----|---|----|-----|-----|

PREPARATIONS RECEIVED FOR DIAGNOSIS  
DURING THE YEAR 1920.

|  |       |     |    |     |   |   |   |     |     |     |
|--|-------|-----|----|-----|---|---|---|-----|-----|-----|
|  | 1,827 | 167 | 75 | 113 | 4 | 5 | 4 | ... | ... | ... |
|--|-------|-----|----|-----|---|---|---|-----|-----|-----|

*African Coast Fever.*—The forty-five smears recorded were received almost entirely from the Melsetter and Chipinga outbreaks, smears from the very extensive outbreak at Enkeldoorn being examined by the Veterinary Officer on the spot. It is pleasing to note that this system which I have always advocated has been applied in this outbreak with such marked success.

*Infectious Abortion.*—The following table shows the number of infected herds in the various districts during the year 1921, and the fresh outbreaks detected during the past year:—

## INFECTIOUS ABORTION.

| District.  | Sub-district.      | No. of herds infected, 1921. | New outbreaks detected, 1922. |
|------------|--------------------|------------------------------|-------------------------------|
| Umtali—    |                    | 3                            | 2                             |
|            | Headlands ... ..   | 1                            | —                             |
|            | Macheke ... ..     | 4                            | 4                             |
|            | Rusape ... ..      | 3                            | 1                             |
| Melsetter— |                    | 2                            | 1                             |
|            | Chipinga ... ..    | —                            | 1                             |
| Salisbury— |                    | 10                           | 4                             |
|            | Arcturus ... ..    | 2                            | —                             |
|            | Beatrice ... ..    | 6                            | 1                             |
|            | Bindura ... ..     | 4                            | 4                             |
|            | Borrowdale ... ..  | 4                            | 1                             |
|            | Bromley ... ..     | 3                            | —                             |
|            | Gatooma ... ..     | 6                            | 2                             |
|            | Hartley ... ..     | 5                            | 1                             |
|            | Lomagundi ... ..   | 11                           | 9                             |
|            | Marandellas ... .. | 12                           | 1                             |
|            | Mazoe ... ..       | 3                            | 1                             |
|            | Mrewa ... ..       | 1                            | 4                             |
|            | Norton ... ..      | 2                            | —                             |
|            | Shamva ... ..      | 1                            | —                             |
| Victoria—  |                    | 2                            | 2                             |
|            | Chibi ... ..       | 1                            | —                             |
|            | Chilimanzi ... ..  | 1                            | 1                             |
| Gwelo—     |                    | 10                           | 5                             |
|            | Enkeldoorn ... ..  | 4                            | 1                             |
|            | Felixburg ... ..   | 2                            | —                             |
|            | Que Que ... ..     | 10                           | 2                             |
|            | Selukwe ... ..     | 3                            | 2                             |
|            | Umvuma ... ..      | 6                            | 2                             |
| Bulawayo—  |                    | 2                            | 3                             |
|            | Belingwe ... ..    | —                            | 2                             |
|            | Francistown ... .. | —                            | 1                             |
|            | Shangani ... ..    | 2                            | —                             |
|            | Usher ... ..       | —                            | 2                             |
|            |                    | 122                          | 60                            |

The above table is compiled from the laboratory records showing the outbreaks detected by the pipette method which since 1915 has been used in this country for the detection of infectious abortion by the agglutination test. The method is so simple that even laymen can collect the necessary samples of blood and forward them to the laboratory in a suitable condition for diagnosis. It may be claimed that its use has largely contributed to the control of the disease in this country and has led to the detection of the disease not only where abortions have occurred, but on ranches where the small calf crop alone indicated its presence. The administrative side of the department has

continued to base its regulations for the control of the disease upon the use of the "devitalised vaccine," which has continued to produce most favourable results. It has been claimed that these results may be attributed to the supposed tendency of the disease to "wear itself out," but the very definite manner in which the cessation of abortions has synchronised with the application of the vaccine is most remarkable. Over 41,000 doses of this vaccine have been issued during the year. The following figures have been compiled from the reports collected and supplied by District Veterinary Surgeons concerning herds treated with the "devitalised vaccine" in their respective districts:—

|                                                                     |      |
|---------------------------------------------------------------------|------|
| Total reports received ... ..                                       | 104  |
| Reports incomplete or of no statistical value ... ..                | 45   |
|                                                                     | —    |
|                                                                     | 59   |
| Herds in which no further abortions occurred after treatment ... .. | 28   |
| Herds in which abortions practically ceased after treatment—        |      |
| 4 in which 1 abortion was recorded                                  | } 20 |
| 5 in which 2 abortions were recorded                                |      |
| 4     "     3     "     "                                           |      |
| 5     "     4     "     "                                           |      |
| 2     "     5     "     "                                           |      |
| Herds in which abortions continued ... ..                           | 11   |
|                                                                     | —    |
|                                                                     | 59   |

Although it must be admitted that at the present time there is no vaccine known which will cure or prevent infectious abortion, it may be claimed that the results obtained with the "devitalised vaccine" issued by this laboratory have been most encouraging. There would therefore appear no necessity to resort to the use of the live vaccine, which, if alive in the sense that it is virulent or pathogenic, is dangerous owing to the risk of setting up infection in pregnant animals inoculated in error, or in non-pregnant animals which may occasionally become infected. Schroeder, a well-known American authority, has pointed out that if a vaccine is to be successful, "large or repeated doses are required to produce an effective immunity." As the inoculation of a pregnant animal with a live virus is impossible, the necessary repetition of injections cannot be applied; and since according to the same authority "cows injected with living bacilli may become, through the infection of their udders, long persistent, dangerous carriers and disseminators of abortion bacilli," the dangers associated with the live vaccine and the advantages of an alternative method free from them will be appreciated.

*Horse-Sickness.*—The following is a summary of Police horses inoculated against horse-sickness and results during the past eight years:—

SUMMARY OF POLICE HORSES INOCULATED AGAINST  
HORSE-SICKNESS AND RESULTS DURING THE  
PAST EIGHT YEARS.

| Season.               | Number treated.        | Died under treatment. | Number of inoculated horses exposed. | Died on exposure. | Died from other causes. | Sold. |
|-----------------------|------------------------|-----------------------|--------------------------------------|-------------------|-------------------------|-------|
| 1915 and prior to ... | 6                      | 1                     | 5                                    | ...               | ...                     | ...   |
| 1915—16 ...           | 32                     | 2                     | 35                                   | ...               | 8                       | 3     |
| 1916—17 ...           | 115                    | 17                    | 122                                  | 14                | 12                      | 5     |
| 1917—18 ...           | 29                     | 6                     | 114                                  | 9                 | 3                       | ...   |
| 1918—19 ...           | 38                     | 7                     | 133                                  | 4                 | 3                       | 4     |
| 1919—20 ...           | 185                    | 14                    | 293                                  | 10                | 15                      | 19    |
| 1920—21 ...           | 57                     | 9                     | 297                                  | 6                 | 10                      | 8     |
| 1921—22 ...           | ...                    | ...                   | 273                                  | 2                 | 12                      | 10    |
| Total ...             | 462<br>= 12½ per cent. | 56                    | 1,272<br>= 3.6 per cent.             | 45                | 63                      | 49    |

SHOWING NUMBER OF SEASONS SURVIVED BY  
INOCULATED HORSES.

| Date inoculated.  | Number inoculated. | Died under inoculation. | Leaving. | Seasons survived. |    |    |    |    |     |     |     |
|-------------------|--------------------|-------------------------|----------|-------------------|----|----|----|----|-----|-----|-----|
|                   |                    |                         |          | 8.                | 7. | 6. | 5. | 4. | 3.  | 2.  | 1.  |
| 1915 and prior to | 6                  | 1                       | 5        | 3                 | 3  | 3  | 4  | 4  | 4   | 4   | 5   |
| 1915—1916 ...     | 32                 | 2                       | 30       | 13                | 14 | 23 | 25 | 25 | 27  | 30  |     |
| 1916—1917 ...     | 115                | 17                      | 98       |                   |    | 65 | 73 | 76 | 77  | 77  | 86  |
| 1917—1918 ...     | 29                 | 6                       | 23       |                   |    |    | 17 | 19 | 21  | 21  | 21  |
| 1918—1919 ...     | 38                 | 7                       | 31       |                   |    |    |    | 24 | 27  | 30  | 31  |
| 1919—1920 ...     | 185                | 14                      | 171      |                   |    |    |    |    | 146 | 153 | 171 |
| 1920—1921 ...     | 57                 | 9                       | 48       |                   |    |    |    |    |     | 46  | 48  |



|                                                      |   |   |     |   |   |   |
|------------------------------------------------------|---|---|-----|---|---|---|
| 16 horses out of 35 exposed have survived 7 seasons. |   |   |     |   |   |   |
| 82                                                   | " | " | 133 | " | " | 6 |
| 116                                                  | " | " | 156 | " | " | 5 |
| 148                                                  | " | " | 187 | " | " | 4 |
| 300                                                  | " | " | 358 | " | " | 3 |
| 358                                                  | " | " | 406 | " | " | 2 |
| 392                                                  | " | " | 406 | " | " | 1 |

*Note.*—These figures include deaths and reductions from causes other than horse-sickness.

The above return supplied by the Chief Staff Officer relates to the inoculation of horses for the British South Africa Police which has been carried out during the past ten years under my personal supervision, and shows a very satisfactory reduction in the death rate of inoculated horses when exposed to natural infection. Whereas in pre-inoculation days the mortality in some years when natural infection was severe is said to have been as high as 50 per cent., the death rate on exposure during the past year was less than 1 per cent., and in a period of seven years has averaged only 3.6 per cent. The mortality of horses under treatment in the previous year was 7.5 per cent., but in the year under review increased to 15.7 per cent. This is explained by the fact that during my absence on leave the strain of virus-vaccine which had proved so successful was lost and a number of horses were sacrificed in the endeavour to obtain a new one. Thus in one batch of twenty as many as six died, which greatly increased the average. For a similar reason the inoculation of horses for the public, which for the previous two years had been entrusted to the professional members of the Veterinary Department with considerable success, did not prove so satisfactory when the new vaccine was applied, and it was thought wise to suspend further inoculation until a suitable method had been devised which could be applied with a greater certainty of obtaining uniform results. It is hoped that when it becomes possible to devote the necessary time and attention to the work this difficulty may be speedily overcome.

*Redwater and Gall-Sickness.*—Although at the present time there is no market for our cattle, it is hoped that one may be found at an early date. But if full advantage is to be taken of it, it is necessary not only to increase the quantity, but also to improve the quality of our animals. This can only be done by the introduction of pure-bred bulls for the improvement of our local stock. At present, however, in addition to the initial cost of such animals and the heavy freight and railrage charges, there is always the danger of them contracting redwater and gall-sickness through the bite of the tick. Until systematic dipping has completely eradicated the tick from the country, the best means of protecting susceptible cattle is by inoculation. The method hitherto employed has recently been greatly improved by the introduction of a double process, whereby suitable animals from overseas can be inoculated on the farm by the owner himself. So long as the tick remains, cattle which have grown up on farms where dipping has been regularly practised will be liable to contract these diseases when removed to tick-infested veld. To prevent this the method of inoculating young stock "at heel," as practised during the last few years, has proved very successful, and is now employed by many of the leading stock-breeders

in the country. The more general application of the process is probably prohibited by the cost of the vaccine, the price of which should be reduced.

*Quarter-Evil.*—One of the primary objects of the new laboratory was the preparation of vaccines against local diseases, at lowest cost to the farmer. At one time the demand for quarter-evil vaccine exceeded the supply, and various proprietary preparations were imported, some of which did not prove entirely satisfactory, but the aggressin and the vaccine prepared by Leclairinche and Vallee have for some time yielded most satisfactory results. In the Union difficulty has arisen from the fact that the powder vaccine issued to protect animals against quarter-evil did not protect against infection with malignant oedema, but although that organism is present in nearly all carcasses and is probably a regular inhabitant of the intestines of most animals in this country, "break-downs" in cattle treated with the above proprietary vaccines have not occurred. The issue of these vaccines has been entrusted to private firms, and as under existing conditions the additional work associated with the preparation and testing of a vaccine cannot be undertaken, we shall have to rely upon and be prepared to pay for the imported products.

*Vaccines.*—The following table shows the vaccines prepared during the year. The price of the infectious abortion vaccine which was 1s. per dose was reduced in June to 6d. a dose. The suspension of the issue of horse-sickness virus-vaccine is responsible for a reduction in revenue of about £500 as compared with the returns for last year. The issue of redwater and gall-sickness vaccine has slightly increased and the demand might be greater if the price were reduced.

*Infectious Abortion Vaccine.*

|                                        |            |
|----------------------------------------|------------|
| 664 doses issued free of charge ... .. | —          |
| 41,881 doses, value ... ..             | £1,544 5 0 |

*Horse-Sickness Vaccine.*

|                                                        |        |
|--------------------------------------------------------|--------|
| 52 doses 1st inoculation for horses at £1 per dose ... | 52 0 0 |
| 1 dose 2nd inoculation for horses at 5s. per dose ...  | 0 5 0  |
| 50 doses for inoculation of mules at £1 per dose ...   | 50 0 0 |

*Redwater and Gall-Sickness Vaccine.*

|                                                 |             |
|-------------------------------------------------|-------------|
| 768 doses, value ... ..                         | 90 9 0      |
| Fees for inoculation at research station ... .. | 105 0 0     |
|                                                 | <hr/>       |
|                                                 | £1,841 19 0 |

# Chemical Composition of White and Yellow Maize.

By G. N. BLACKSHAW, O.B.E., B.Sc., F.I.C., Chief Chemist,  
Department of Agriculture.

In order to compare the respective chemical compositions of white and yellow maize, analyses of commercial first grade samples of the under-mentioned varieties of Union-grown yellow maize, kindly supplied by the Principal, School of Agriculture, Potchefstroom, and of Rhodesian-grown white dent maize have been carried out by Mr. A. W. Facer, B.A., A.I.C., at the Agricultural Laboratory, Salisbury.

| White dent maize.                 | Yellow flint maize. | Yellow dent maize.                                                                                   |
|-----------------------------------|---------------------|------------------------------------------------------------------------------------------------------|
| Salisbury White.<br>Hickory King. | Red Cob Congo.      | Minnesota 13.<br>Chester County.<br>Palins Cornflake.<br>Natal Yellow Horsetooth.<br>German Yellow.* |

\*German Yellow is not a fixed type, being a cross between flint and dent varieties.

The results of the analyses are set forth in the following table:—

COMPOSITION OF VARIETIES OF WHITE AND YELLOW MAIZE.

| Name of variety.                                                        | German Yellow. | Red Cob Cango. | Minnesota 13. | Chester County. | Palms Cornflake. | Natal Yellow Horse-tooth. | Salisbury White. | Hickory King. |
|-------------------------------------------------------------------------|----------------|----------------|---------------|-----------------|------------------|---------------------------|------------------|---------------|
| Sample No. ...                                                          | 649            | 650            | 651           | 652             | 653              | 654                       | 655              | 656           |
| 1. Percentage composition :—                                            |                |                |               |                 |                  |                           |                  |               |
| Water ...                                                               | 9.9            | 9.4            | 9.4           | 9.4             | 9.3              | 9.3                       | 10.2             | 9.8           |
| Oil ...                                                                 | 4.9            | 5.0            | 4.5           | 4.7             | 4.4              | 4.6                       | 4.7              | 4.4           |
| Crude protein *                                                         | 11.0           | 10.3           | 9.9           | 10.5            | 9.3              | 9.4                       | 9.3              | 9.3           |
| Carbohydrates (Soluble Fibre)                                           | 71.3           | 72.3           | 72.9          | 71.9            | 73.8             | 73.8                      | 72.9             | 73.9          |
| Ash ...                                                                 | 1.5            | 1.6            | 1.8           | 2.0             | 1.7              | 1.5                       | 1.5              | 1.4           |
|                                                                         | 1.4            | 1.4            | 1.5           | 1.5             | 1.3              | 1.4                       | 1.4              | 1.2           |
| *Containing true protein ...                                            | 10.6           | 9.7            | 9.5           | 10.2            | 9.2              | 8.8                       | 9.0              | 8.8           |
| 2. Percentage composition of dry matter :—                              |                |                |               |                 |                  |                           |                  |               |
| Oil ...                                                                 | 5.4            | 5.5            | 4.9           | 5.1             | 4.8              | 5.0                       | 5.2              | 4.8           |
| Crude (True protein                                                     | 11.8           | 10.7           | 10.5          | 11.3            | 10.1             | 9.8                       | 10.0             | 9.8           |
| protein (Other nitrogenous substances ...                               | 0.4            | 0.6            | 0.5           | 0.3             | 0.4              | 0.6                       | 0.3              | 0.5           |
| Carbohydrates (Soluble Fibre)                                           | 79.2           | 79.8           | 80.5          | 79.4            | 81.4             | 81.5                      | 81.3             | 82.0          |
| Ash ...                                                                 | 1.7            | 1.8            | 2.0           | 2.2             | 1.9              | 1.6                       | 1.7              | 1.6           |
|                                                                         | 1.5            | 1.6            | 1.6           | 1.7             | 1.4              | 1.5                       | 1.5              | 1.3           |
| 3. Amount (in pounds) of digestible nutrients in 100 lbs. dry matter :— |                |                |               |                 |                  |                           |                  |               |
| Oil ...                                                                 | 5.0            | 5.1            | 4.6           | 4.7             | 4.5              | 4.6                       | 4.8              | 4.5           |
| Crude (True protein                                                     | 8.7            | 7.9            | 7.7           | 8.4             | 7.5              | 7.2                       | 7.4              | 7.2           |
| protein (Other nitrogenous substances ...                               | 0.3            | 0.5            | 0.4           | 0.2             | 0.3              | 0.5                       | 0.2              | 0.4           |
| Carbohydrates (Soluble Fibre)                                           | 74.4           | 75.0           | 75.7          | 74.6            | 76.5             | 76.5                      | 76.4             | 77.1          |
|                                                                         | 1.0            | 1.0            | 1.1           | 1.2             | 1.1              | 0.9                       | 1.0              | 0.9           |
| Gross digestible energy, expressed as starch, in 100 lbs. of dry matter | 97.9           | 97.9           | 97.3          | 97.3            | 97.5             | 97.4                      | 97.8             | 97.5          |

Oil = Ether extract.

Protein = Nitrogen x 6.25.

It is well known that maize takes some time to "dry out" after it has been harvested, and further that the moisture content of the grain even after drying out is influenced by changes in atmospheric conditions, consequently in the above table not only is the actual quantity of each constituent present in the grain as taken for analysis stated, but also the percentage amount of each constituent contained in the moisture-free grain (*i.e.*, the percentage composition of the dry matter of the grain) is given, so that the quantities are referred to a fixed basis.

As will be seen on reference to the table, the amounts of fibre, ash and nitrogenous substances other than true protein in maize are comparatively small and subject only to small variation; the amount of fibre in the dry matter of the samples examined varying from 1.6 per cent. to 2.2 per cent., that of ash from 1.3 per cent. to 1.7 per cent., and that of nitrogenous substances other than true protein from 0.3 per cent. to 0.6 per cent. In comparing the composition of the samples, those constituents do not therefore call for comment beyond the general observation that all breeds of maize are characteristically deficient in bone-forming material on account of the small amount of ash they contain and the low proportion of lime in the ash.

Bearing in mind (1) that the carbohydrates (starch, sugar, etc.) and oil digested from food function in the animal body as producers of heat, energy and fat, and (2) that the protein is able not only to perform those functions, but also to develop flesh and restore the waste of nitrogenous body tissue; we observe from the number of pounds of digestible nutrients in 100 lbs. of the dry matter that maize is essentially a "carbohydrate" or "heat, energy and fat forming" foodstuff, the amount of *digestible carbohydrates* in the dry matter varying in the samples from 75.4 per cent. in German Yellow to 78 per cent. in Hickory King, the average for the two white dent samples being 77.7 per cent., for the four yellow dents 76.9 per cent., and for the yellow flint sample 76 per cent.

The amount of *digestible oil* contained in the dry matter of the samples varied from 4.5 per cent. in Hickory King and Palins Corn-flake to 5.1 per cent. in the yellow flint sample Red Cob Congo, the average for the two white dents being 4.65 per cent., and for the four yellow dents 4.6 per cent. It would thus appear that yellow flint breeds show a somewhat higher digestible oil content than white and yellow dents, but in comparing the compositions of these samples it has to be remembered that the amount of a constituent varies to some extent even in the same variety, and consequently the difference has to be uniformly notable before it can be claimed that one variety of maize has an advantage over another in any constituent. Juritz,\* in reporting upon the composition of twelve samples of Hickory King maize grown in the Cape Province and Orange Free State, shows that the oil content of the dry matter varied from 4.6 per cent. to 6.8 per cent., the average of the twelve samples being 5.1 per cent. Henry and Morrison† give the average oil content of the dry matter of

\* Bulletin 44, 1913, Union of South Africa Department of Agriculture.

† *Feeds and Feeding*, by Henry & Morrison, 15th Edition.

American-grown maize as 5.5 per cent. for dents and 5.6 per cent. for flints.

The *digestible true protein* content of the dry matter of the samples enumerated in the table accompanying this article varied from 7.2 per cent. in Hickory King and Natal Yellow Horsetooth to 8.7 per cent. in German Yellow, the average for the two white dents being 7.3 per cent., and for the four yellow dents 7.7 per cent., whilst the sample of yellow flint contained 7.9 per cent. As with other constituents, the protein content is liable to some variation even in the same variety of maize, which fact can be well illustrated from the information supplied in the report by Juritz, to which reference has already been made, in which it is shown that the *total crude protein* content of the dry matter of fifteen samples of Hickory King maize grown in various parts of the Union varied from 9.2 per cent. to 12 per cent., the average of the fifteen samples being 10.5 per cent. Henry & Morrison give the *total crude protein* content of the dry matter in American-grown dent maize as 11.2 per cent., and flint maize as 11.8 per cent.

From the foregoing particulars it will be seen that there is no uniform difference in the proportions of food nutrients in flint and dent maize. The statement is sometimes made, however, that flint maize is slightly richer in protein than dent maize, and whilst evidence can be adduced to support it, the advantage claimed in that respect is of doubtful significance.

As already pointed out, maize is a "heat, energy and fat forming" foodstuff, or in other words, all breeds of maize lack protein and must be blended with protein-rich foodstuffs to produce a well-balanced ration for stock. Reference to the table of analyses shows that the "gross digestible energy expressed as starch" values of the eight samples are remarkably uniform, thus lending support, from the standpoint of chemical composition, to the statement of Henry & Morrison that "experience opposes the assertion often heard that yellow maize is more nutritious than white, or the opposite. While a certain strain or variety of one may be superior to any particular strain or variety of the other in a given locality, there is no uniform difference between white and yellow maize in productiveness or feeding properties."

## Irrigation Notes.

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Economic conditions in Southern Rhodesia generally are still somewhat adverse to the taking in hand of any very large irrigation schemes. The slump in the cattle market and the difficulties of disposal of produce at remunerative prices cause farmers to hesitate before embarking upon any undertakings of an extensive nature. In spite, however, of the many difficulties with which farmers have to contend to-day, it is pleasing to see many small schemes being considered and carried out. The provision of irrigation loans to approved applicants has been the means of several promising schemes being undertaken. Amongst the various schemes under construction, or for which surveys have been made, may be mentioned the following:—

*Capt. H. De M. Prior, Bullinahore, Victoria.*—A scheme of some promise is being carried out on this farm. The works consist of a low diversion weir in the Popotekwe River and a canal about two-and-a-half miles in length along the right bank. The canal construction is now in hand, and it is hoped to complete the weir later in the season as soon as the river flow has somewhat decreased. The irrigable area is about 40 to 50 acres, and the soil (fair quality red loam) should respond well under irrigation.

*Rawstone Bros., Riverside, Guttooma.*—Surveys were made for the construction of an earth storage dam about 20 feet high in a spruit on this farm. The site is very favourable from a storage point of view, and the water stored would enable about 25 acres of very good land to be placed under permanent irrigation.

*D. Vaughan Clark, Chinyika, Arcturus.*—A hydraulic ram of fairly large capacity is being installed in the Chinyika River. The water will be lifted about 30 feet to a storage reservoir situated on high ground adjacent to the river, and from there a gravitation canal about a quarter of a mile in length will carry it to the lands about 25 acres in extent. Mr. Vaughan Clark proposes to specialise in truck crops and other produce so far not extensively grown in this country.

*Hon. J. Parker, Mapandaguta, Banket.*—A 12 h.p. (nominal) Marshall portable engine and 6 inch Tangye's centrifugal pump have been installed in the Mennenni River and will lift the water about 40 feet for irrigating some 25 acres of good red loam soil on the left bank of the river. In addition to general winter crops, Mr. Parker proposes growing fairly large quantities of green feed for fowls, of which he has nearly 1,000 laying hens.

*F. Warner, Sutton Estate, Banket.*—This is a small gravitation scheme utilising the headwaters of the Mennenni River. The canal is about three-quarters of a mile in length, and will irrigate some 20 acres of light granite soil.

*C. E. Harper, Cawston, Nyamandhlovu.*—A low earth dam has been constructed on this farm in a natural depression which provides a very large storage basin, and a considerable area is brought under irrigation. The dam suffered a little damage during last wet season, and advice has been given concerning the necessary repairs. This scheme has been referred to as one of the most promising in Matabeleland, where irrigation is required often for both summer and winter crops.

*Old Umtali Irrigation Board.*—The Water Court has had before it an application from the owners of land at Old Umtali embraced under this scheme. It decided to grant the use of water from the Odzani River for the irrigation of 775 acres on the three farms concerned. Surveys for the canal have now been made and construction will commence at an early date.

*Native Reserves.*—Considerable water supply development is also taking place in several of the native reserves in Matabeleland, which to a large extent are incapable of occupation until water is provided. Two boring machines are now at work, and windmills and concrete storage tanks are being erected in all cases where adequate supplies are developed.

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## Agricultural Outlook.

Farmers are busily engaged in reaping and shelling the maize crop, which is now estimated to realise 1,447,000 bags from 222,000 acres, constituting records both in total yield and acreage. Some difficulty is being experienced in getting a good grade, owing to discoloured grain and damaged tips, due to the heavy rainfall. The maize is drying out very slowly, owing principally to the lack of sunshine during the maturing period and partly to the large size of the grain; the absence of early frosts is also a contributory factor. Farmers are advised not to stack their maize in bulk until the grain is thoroughly dry, or it will probably become mouldy and therefore useless. Wet maize can of course be dried, but musty maize cannot



be made sweet. The native harvest is a heavy one, and beer drinks are being freely indulged in. Labour in consequence is rather scarce in some districts; on the whole, however, the supply is sufficient to meet the demand.

Many farmers are now adopting the practice of early ploughing recommended by the Department of Agriculture. The benefits derived are very considerable, and we commend the practice to every farmer. Bulletins Nos. 397 and 445 deal with the subject in detail.

Particulars of the area planted to winter wheat this season are not available, but the area utilised is certainly but a small proportion of that available. The re-imposition of the wheat duty should ensure better prices for locally-grown wheat, and consequently lead to greater production. Wheat farmers should select their own seed from suitable varieties, for acclimatised seed is far more suitable than imported seed, which frequently contains seeds of noxious weeds.

So far there have been few veld fires, but with the drying out of the grass these may be expected and should be guarded against. It is of course a penal offence for a person without lawful authority to set alight grass not his own property, and he can also be called upon to pay for any damage caused. Before proceeding to burn grass on his own land, a farmer must give reasonable notice to adjoining occupiers of his intention to burn.

The grazing and water supplies in most parts of the country are good, and should carry stock through the dry season without any difficulty. In some parts, although the grass is luxuriant, it does not appear to hold its usual nutritive properties, for cattle are falling away in condition. The position of the cattle industry is wholly unsatisfactory, a matter which is dealt with elsewhere in this *Journal*.

Deaths from horse-sickness continued so late as June, although the incidence of the disease considerably diminished. The mortality among horses at the end of May amounted to no less than 1,177, a terrible loss to the country.

Complete figures of the rainfall for last season are published in this issue of the *Journal*, from which it will be seen that the mean rainfall over the whole of the country was 9.14 inches above normal. It is intended next season to continue the issue of short period weather forecasts for the guidance of agriculturists.

## Correspondence.

### NAPHTHALINE AGAINST ANTS.

Mr. S. C. Moorcroft, P.O. Marshbrook, writes as follows:—"I was on the point of writing to you to ask if you could suggest some means of ridding my place of brown ants. The whole place seemed to be full of them. . . . They defied the best stuff my chemist could send me; in fact, I think they fattened on it, when by accident I discovered that by scraping a stick of naphthaline with a sharp knife about their runs scared them off in no time. . . ."

Mr. Moorcroft's letter was submitted to the Chief Entomologist, who writes:—

"Naphthaline is, of course, well known to be distasteful to many insects, hence its extensive use in preserving clothes from moth, etc. A number of instances of its application as a means of obtaining protection from insect pests could be cited. It has, however, several drawbacks as an insecticide. In the first place, its action is not very deadly, although the majority of insects certainly object to it. On this account it is used chiefly as a deterrent, which implies continued application; secondly, it is volatile and evaporates comparatively quickly when in a powdered form; and thirdly, its cost is rather too high to admit of its continuous use on a large scale.

"House ants in this Territory are admittedly difficult to eradicate. The species usually involved is *Pheidole punctulata*, Mayr., and this ant agrees with the description given in Mr. Moorcroft's letter. Poisoned sugar solutions, as used against the "Argentine ant" at the Cape, and some other species, are hopelessly ineffective. As deterrents, however, we have two substances which are cheaper than naphthaline. The one is Cooper's sheep dip powder, which can, of course, only be used where there are no very young children in the house. Powdered white arsenic appears to have a similar action, but the yellow colour of the sheep dip powder advertises its nature, and is, therefore, preferable. The other is sodium fluoride, which is also one of the best agents against cockroaches. These substances, when sprinkled about the runways of the ants, very quickly cause them to abandon that particular hunting ground, although not necessarily to vacate the premises altogether. Their application is likely, however, to be as extensive as that of naphthaline, and they have on occasion been used with such success that houses which were absolutely swarming with the pests were rendered for practical purposes free, and maintained in this condition by timely application of the powder when the ants put in a fresh appearance."

# Southern Rhodesia Veterinary Report.

May, 1923.

## AFRICAN COAST FEVER.

CHARTER DISTRICT.—Fresh outbreaks occurred on the farms Kopje Alleen and Onze Rust, both in the western section of the district and about twenty miles from Enkeldoorn. Police cordons were posted immediately and three-day dipping instituted. The mortality during the month was as follows:—Kopje Alleen 12, Onze Rust 12, Stockdale 2, Rockydale 3, Hoffmania 6, Mangeni Reserve 1, Narira Reserve 3.

MELSETTER.—A fresh outbreak occurred on the farm Morgenson, within a few miles of the existing centre of infection, Randfontein. Nine head died or were destroyed.

## CONTAGIOUS ABORTION OF CATTLE.

Fresh centres of infection were found in the Salisbury, Hartley, Umtali and Gwelo districts.

The District Veterinary Surgeon, Gwelo, states that the results of vaccinating between three and four thousand cows on one of the large ranches in his district are apparently unsatisfactory.

## TRYPANOSOMIASIS.

In the Lomagundi district about 40 head of cattle died from this disease.

## HORSE-SICKNESS.

The following mortality was reported:—Melsetter 22 (including 3 mules), Umtali 10, Makoni 2, Inyanga 3, Lomagundi 2, Salisbury 10, Mazoe 5, Mrewa 3, Marandellas 5, Bindura 9, Hartley 11 (including 9 not reported the previous month), Selukwe 3, Umvuma 1, Insiza 4, Inyati 4, Bulawayo 5, Matobo 12, Plumtree 1, Victoria 9, Gwanda 2.

## EQUINE PERNICIOUS ANÆMIA.

The District Veterinary Surgeon, Melsetter, reports two horses affected with what he believes to be pernicious anæmia.

## IMPORTATIONS.

From the Union of South Africa:—Bulls 37, heifers 11, horses and mules 78, goats 606, sheep 1,535, pigs 16.

### EXPORTATIONS.

To Union of South Africa:—Slaughter cattle 1,420, breeding cattle 1,060, sheep 50. To Northern Rhodesia:—Horses 3, pigs 2, sheep 70, cows 5. To Belgian Congo:—Cows 30. To Portuguese East Africa:—Cows 75, heifers 29, bulls 6, calves 8, sheep 67.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

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## Farming Calendar.

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### August.

#### BEE KEEPING.

Now that warmer weather prevails, hives can be opened with safety and examined. Do this when the sun is shining and without exposing the bees too long. The queens are now laying, and, should there be a scarcity of food, feed the bees with syrup inside the hive. Where a hive carries a fair supply of honey, queens can also be encouraged to produce eggs by crushing with a knife blade the cappings of sealed honey still remaining in brood combs. This month and next bees will be collecting nectar and pollen from fruit and bush bloom. Where strong south-easterly winds prevail, hive entrances should be shielded. This will afford bees great assistance in their going out and coming in.

#### CITRUS FRUITS.

Orange trees should already have been pruned, and should now be ready for the first irrigation. The first growth should be commencing early in the month, and by this time the trees should already have had one good soaking. As soon as the trees have set their fruit they should never be allowed to stop growing through lack of moisture, otherwise the fruit is liable to be poor in quantity and lacking in quality. After irrigation, cultivation should follow, and the earth round the trees be loosened with a spade. If fertiliser is to be used, it should be applied after the first irrigation, so as to be thoroughly incorporated with the soil in the cultivation following.

#### CROPS.

Provided there are no heavy frosts, dhal may be allowed to remain until August before harvesting. As a second or third year crop, dhal can always be cut earlier, say towards the end of June or July. Ploughing should be undertaken continuously wherever possible; the value of early ploughing cannot be over-estimated. Except on light sandy soils, ploughing

should be followed as soon as possible by harrowing. Mangels can be pulled out and fed as required. The ensilage pit can be opened and the contents fed. Seed potatoes should be worked over and decayed tubers removed.

In cereals under irrigation care should be taken to weed out any Drabok or Darnel (*Lolium temulentum*) that may be growing among the crop, as the presence of this weed is injurious. Care should be taken not to over-irrigate any of the lands. Early crops of potatoes under irrigation or on vlei soils will be planted this month.

### DAIRYING.

This is one of the slackest months in the year. Cows should be getting a full ration of ensilage or other succulent food preparatory to calving down in September or October; this will enable them to pick up rapidly and start producing milk in quantity without any leeway to be made up. Butter is easily made during this month, but on cold mornings the cream should be warmed slightly to bring it to a temperature of from 62 to 64 degrees. If this is not done, churning is prolonged over an indefinite period, varying with the breed of the cow. If cheese is being stored, the store room should be kept moist by allowing a bath of water to stand there, or by hanging up wet sacking or sheets in the room. The dairy should be whitewashed, and the shelves scrubbed with hot water containing a little formalin or permanganate of potash preparatory to the coming season.

### ENTOMOLOGICAL.

*Potato*.—Early planted crops of potatoes may be attacked by caterpillars. The crops should be sprayed immediately with an arsenical wash.

*Cabbage Family*.—Young plants of this family should be kept sprayed with an arsenical wash to check attack by webworm. Do not spray plants of which the foliage is to be eaten within three weeks of use.

*Onion*.—May still be troubled with thrip. Use tobacco wash or paraffin emulsion.

*Deciduous Fruits*.—Any trees infested with scale may be sprayed with a winter wash during August. Lime sulphur salt wash or scaleside is recommended.

*Guava*.—Collect and destroy remnants of late crops to keep down citrus codling, especially if trees are in vicinity of citrus orchards.

### FLOWER GARDEN.

Complete digging or forking over the soil as early as possible. Divide and replant dahlias, delphiniums, Shasta daisies, etc. Plant bulbs—tuberose, arum lilies and gladioli. Sow seeds of hardy annuals. Mulch newly-planted roses, shrubs, etc.

### VEGETABLE GARDEN.

Plant out asparagus, cabbage, cauliflowers, onions and early potatoes. Sow seeds of tomato and other plants that are susceptible to frost in a sheltered position; also seeds of various vegetables and salads for summer use.

### FORESTRY.

Cuttings of ornamental shrubs, roses, etc., struck in sand last month should be transplanted into good soil as soon as they shew a good healthy growth of leaves. A large percentage of cuttings will damp off if left in sand longer than about six weeks. No manure should be added to the potting soil. Seed beds should be prepared and gum seeds sown if required for planting early in the season. If the trees are to be grown in seed beds only and not in tins, then gum seeds should not be sown until October, or later, as they will get too large.

## GENERAL.

Fireguards should be completed and every precaution taken to guard against loss of grazing from fires. Natives commence ploughing their softer land this month, and for this reason, as well as because beer is plentiful at the kraals, local labour is apt to be scarce. At this time of the year, however, the need for boys on farms is not so severely felt as later on.

## POULTRY.

Very little hatching should be carried out after the end of this month. Such chicks as are hatched during September will require very special care to bring them along without set-backs. Far too many chicks in this country are hatched too late, with the result that they develop slowly, are stunted, and never make good, profitable stock.

The pullets hatched in April should soon be coming on to lay, and should be in the quarters in which it is intended to keep them during their first year of laying. All when four and a half to five months old should be drafted to these quarters and not moved; if they are moved after they have started laying, they will stop and go into a partial moult.

The early hatched cockerels, that is, all except the very best, should by this time have been killed or marketed for killing purposes; it does not pay to keep them a moment longer than necessary. Needless to say, all pullets and cockerels should have been run in separate sections as soon as the sex can be distinguished; to do so ensures better and more profitable birds. Before putting the pullets into their new quarters, these should be thoroughly cleaned and disinfected. With the advent of warmer weather, a more strenuous war should be waged on insects. Disinfection and spraying of the houses and runs cannot be too thorough or constant; failure to carry this out is responsible to a very large degree for poor quality birds and a low production of eggs.

Special attention should be given to young turkeys, in order to bring them along quickly for the Christmas sales, and so reap a larger profit; after this period the demand for some time is as a rule poor.

Ducks too require special attention to keep them laying; without good, dry, warm sleeping quarters they will not produce eggs to any appreciable extent.

## STOCK.

*Cattle.*—On the early granite and sand veld probably the worst of winter is over so far as grazing is concerned, and a nice bite of green grass is appearing. Care should be taken where cattle are allowed to graze on the early burnt grass not to let them get too much at first. On diorite farms the haystack will still be required, and in all cases a certain amount of hay or ensilage should be held in reserve against the possibility of very late rains. The bulls may again be put back into the herds. Any very young calves should be kept near home, and dipping should be carefully attended to. In dairy herds on any soil whatever, feeding, housing and bedding cannot be relaxed. Cows in full milk will benefit by a ration of, say, 5 lbs. of maize (crushed and soaked), 30 lbs. to 40 lbs. of ensilage or pumpkin and 8 or 10 lbs. of hay. If it is possible to give, in addition to the above daily ration, 2 lbs. of peanuts, crushed with the shell, or linseed ground with maize, or peanut cake, a very great benefit will be derived. Calves, especially young ones, must be carefully watched; they should not run too far, and are better inside, except when the weather is warm. It will pay to feed to them a little sweet hay, bean meal, linseed, peanuts or peanut cake and a small ration of green food.

*Sheep.*—Sheep should give little trouble at this time of the year, but on very dry veld a handful of mealies and a little hay or ensilage will materially assist ewes with young lambs.

## VETERINARY.

Redwater and gallsickness occur all the year round, although these diseases are more prevalent during the summer months. A good many deaths occur this month, however, amongst imported stock. Vegetable poisoning will probably be in evidence. Sheep can be inoculated against blue tongue. Scab is a poverty winter disease.

## WEATHER.

No rain is to be expected, and even on our eastern mountains the precipitation is trifling. Showers, however, do occasionally fall in places, but are of no consequence. The sun is often warm during the day, but the nights are apt to be cold, and grazing being scarce, food and shelter are necessary for the stock.

## September.

## BEE KEEPING.

In sheltered localities many trees in the bush will now be in bloom. Should there be indications of swarming, put on a crate of sections or shallow frames, correctly fitted with super-foundation. Where a swarm has been secured, place it in a modern hive, and from an established stock remove a frame of comb containing unsealed brood and honey, shake off the adhering bees on to their own alighting board, then insert this comb into the centre of the newly hived swarm. This plan compels the bees to start work at once. As a means of preventing the escape of the queen, a narrow strip of excluder zinc may be fastened at the entrance. This should be removed after about two weeks.

## CITRUS FRUITS.

If the trees were irrigated early in August, the next application of water should be given about the first or second week of this month. After irrigation, cultivation should follow. Constant attention should be given to young trees, and a watch kept for any adventitious shoots or suckers, which should be cut away at once. This should be attended to right through the growing season.

CROPS.—See August.

## ENTOMOLOGICAL.

*Tobacco*.—Young plants in seed beds may suffer from cutworms. See *Rhodesia Agricultural Journal*, February, 1920.

*Potato*.—Early potatoes are liable to suffer from caterpillars. The crop should be sprayed at first sign of injury with an arsenical wash.

*Cabbage*.—During this month the most prominent enemies of plants of this family are diamond back moth and webworm. Cabbage louse is sometimes troublesome. The young plants may be sprayed or dusted with an arsenical compound for the former, and sprayed with tobacco wash and soap for the latter.

*Beans* planted under irrigation during September usually escape serious infestation with stem maggot.

*Citrus Trees*.—Scale insects commence to increase rapidly with the advent of warmer weather, but the trees should not be sprayed or fumigated while in blossom.

### FLOWER GARDEN.

Cultivate extensively to prevent evaporation and to keep weeds in check. Water plants newly set out, especially such as have their roots near the surface. Thin and regulate growing shoots on roses and various shrubs. Plant out cannas and chrysanthemums (for massing and border decorations) and other herbaceous plants.

### VEGETABLE GARDEN.

Sow French beans, leek, spinach, cucumber, egg plant, celery, rhubarb, melons and tomatoes. Small sowings of peas, turnips, beet, lettuce, radish, carrot, parsnip may be made now.

### FORESTRY.

All cuttings struck in sand in July and not yet transplanted into good soil should have this done as soon as possible. All gum seeds should be planted now if it is intended to grow the transplants in tins. If they are to be grown in beds only, don't plant gum seeds until next month. The seed beds may with advantage be prepared now and watered to make the weed seeds germinate, so that they may be destroyed before planting next month.

### GENERAL.

Indigenous labour is apt to become more scarce at this time of the year, the boys returning to their kraals to break up the land for next season. Stock are liable to stray in search of the young grass now coming up, and much trouble from this cause is to be looked for on unfenced farms. Natives are now cultivating their gardens preparatory to sowing their crops, which they do much earlier than do Europeans. The mischief caused by veld burning becomes apparent from this time onwards in the condition of the stock, and it is necessary frequently to move them away in search of grazing.

### POULTRY.

In view of the high prices of poultry foods, every farmer and poultry keeper is advised to grow as much food (grain and green foods) as possible not only for the requirements of his own birds, but also for sale. Don't delay with the sowing and planting of such foods. One of the most useful and economical poultry foods is the sunflower; the small black is the best. Mealies, wheat, buckwheat, linseed, monkey nuts, beans and peas are all excellent poultry foods to grow. Among the best green foods to grow are sunflower leaves, dhal, lucerne, ground nut leaves, kudzu vine, sweet potatoes, Swiss chard, Chinese cabbage, etc.

During this month all houses and pens should be thoroughly overhauled and disinfected. The houses should be made absolutely watertight in view of the coming rainy season. A damp house is most conducive to illness and a less number of eggs.

All breeding pens should be broken up during the month, the breeding birds put on free range for six weeks or so, and then brought into laying houses. The male birds should be gone over carefully, and all without exception which show signs of lack of vigour, or which will be too old next year, eaten or sold for killing. Only the very best should be retained for next season's breeding and mated to the best of their daughters.

Shade should be provided for the younger chicks. A few small grass shelters will suffice if there is no natural shade. See that the drinking water is in the shade. Give the later hatched chicks as much food as they will eat. Chopped onions or preferably green onion tops will act as a good tonic and improve their appetites.

Young ducklings must be kept out of the sun. This is fatal to them, as they are very subject to sunstroke.



Keep a good lookout for insects either on the adult or young stock and in the houses, and if found, eliminate at once. No chick, duckling or young turkey can possibly thrive if they are irritated by these, and adult birds will not lay well.

### STOCK.

*Cattle.*—Ranching cattle should require little now in a normal season; it is only in the event of very late rains that trouble should be expected. Where possible, it will be wise to keep an eye on those cows that may be expected to calve early, with a view to feeding them if necessary, and seeing that they do not get too poor. The dairyman will carry on much as in August; he will, however, use his discretion (in accordance with the condition of his veld) as to the use of ensilage, pumpkins or other bulky and succulent food. He will be wise not to shorten the supply of concentrated foods for some time to come. A little hay or ensilage should still be kept in reserve until the rains have fallen in reasonable abundance.

*Sheep.*—The remarks for August apply. If spring lambs are expected, it will be wise to see that the sheep shed is in good order—clean, dry, properly drained and airy. Watch that the ewes shall not be poor when they lamb, and remember that they cannot rear good lambs if the veld is bad, but must have their grazing supplemented, just as milk cows are fed in order to produce milk.

### TOBACCO.

Begin sowing seed beds each fortnight for the acreage proposed to be planted; fertilise and stimulate growth so as to be ready for planting out should rain come early in November.

### VETERINARY.

There should be very few deaths from redwater and gallsickness this month. Cases of vegetable poisoning of stock picking up tempting young green shoots of dangerous character on the burnt veld are of frequent occurrence. Sheep can be inoculated against blue tongue, but ewes in lamb should not be treated, on account of the danger of abortion. Scab may be prevalent.

### WEATHER.

The temperature may be expected to rise steadily during this month. Rains are not due until next month, though the average over a period of years shews slightly more than in the previous four months, and ranges between .1 and .5 inch. Frost has been known to occur in September, although this is a very unusual event. Rain-gauges should be seen to before the rains commence. They should be carefully adjusted to stand exactly level with the lip four feet above ground, and care should be taken that no tree, building or other obstruction interferes with the fair precipitation of rain into the orifice.

## Southern Rhodesia Weather Bureau.

MAY AND JUNE, 1923.

*Pressure.*—During the month of May the mean barometric pressure was below normal over the whole country, and varied from about normal at Gwelo to 0.03 in. below normal at Salisbury. The fluctuations in the barometric pressure during the month were large, varying from 0.27 in. at Umtali to 0.19 in. at Salisbury. High pressure areas were present on the 1st, 3rd, 17th, 22nd and 26th to 31st; the maximum high on the 31st was 0.10 in. above normal at Bulawayo, and 0.07 in. above normal at Salisbury.

The minimum low on the 14th was 0.13 in. below normal at Bulawayo, and 0.12 in. below normal at Salisbury.

During the month of June the mean barometric pressure was about normal, and varied from 0.01 in. below normal at Bulawayo to 0.01 in. above normal at Gwelo.

The fluctuations in the barometric pressure during the month were large, the maximum range varying from 0.27 in. at Bulawayo to 0.23 in. at Umtali.

High pressure areas were present on the 1st to 2nd, 5th to 7th, 10th to 13th and 20th to 27th, the maximum high on the 12th being 0.13 in. above normal at Bulawayo, and 0.11 in. above normal at Salisbury. The maximum low occurred on the 18th, and was 0.14 in. below normal at Bulawayo, and 0.13 in. below normal at Salisbury.

*Temperature.*—During May the mean temperature was below normal generally and varied from 1.0° above normal at Gwelo to 2.1° below normal at Umtali.

The mean daily temperatures varied from 1.4° above normal at Salisbury to 4.2° below normal at Umtali, whilst the mean night temperatures varied from 1.2° above normal at Gwelo to 1.3° below normal at Salisbury.

During June the mean temperature was above normal generally, and varied from 2.6° above normal at Gwelo to 0.5° above normal at both Salisbury and Umtali.

The mean daily temperature varied from 2.2° above normal at Salisbury and Bulawayo to 2.4° below normal at Umtali, whilst the mean night temperatures varied from 3.9° above normal at Gwelo to 1.2° below normal at Salisbury.

*Rainfall.*—Light showers were reported fairly generally during the beginning and middle of May and along the eastern border at the end of the month.

During June light showers were experienced fairly generally in Zones D, E and F during the middle of the month.

During both months the relative humidity was generally high; frosts were infrequent and lighter than usual.

Mean wind direction was approximately normal during both months at Salisbury, being S. 79° E. during May and S. 84° E. during June.

*Yearly Rainfall.*—The mean rainfall over the whole Territory during the year, as obtained from the returns here published, was 9.14 ins. above normal, or 31.3 per cent. above normal.

The heaviest rainfall in the Territory occurred at Stapleford, in Untali district, where 87.28 ins. were recorded, *i.e.*, 36.1 per cent. above normal, and the lightest rainfall at Tuli, in Gwanda district, where 16.37 ins. only were recorded, *i.e.*, 11.4 per cent. above normal. The station at which the greatest deviation above normal was recorded was Bushy Park, in Charter district, where the fall was 79.3 per cent. above normal; whilst the greatest deviation below normal was at Lynwood, in Wankie district, where the fall was 25.6 per cent. below normal.

The following was the position in the different rainfall zones:—

Zone A.—The mean rainfall in this zone was 31.3 per cent. above normal. The district showing greatest deviation above normal was Bulawayo, with 54.2 per cent.; all other districts were above normal, with the exception of Wankie district, where the fall was 1.9 per cent. below normal.

Zone B.—The mean rainfall in this zone was 36.0 per cent. above normal. The district showing greatest deviation above normal was Umzingwane, with 52.5 per cent.; all districts were above normal, the least deviation above normal being in Gwanda district, with 21.8 per cent.

Zone C.—The mean rainfall in this zone was 37.8 per cent. above normal. All districts were above normal, the extremes being Chilizanazi district, with 44.3 per cent., and Sebungwe district, with 31.2 per cent.

Zone D.—The mean rainfall in this zone was 35.8 per cent. above normal. All districts were above normal, the extremes being Inyanga district, with 42.6 per cent., and Mtoko, with 15.7 per cent.

Zone E.—The mean rainfall in this zone was 20.9 per cent. above normal; all districts were above normal, with the exception of north-east Insiza, the extremes being south-east Gwelo district, with 55.0 per cent. above normal, and north-east Insiza district, with 2.3 per cent. below normal.

Zone F.—The mean rainfall in this zone was 21.9 per cent. above normal, the extremes in individual stations being Hoboken, with 43.0 per cent. above normal, and Mount Selinda, with 5.6 per cent. below normal.

*Comparison between Seasonal Rainfall and Forecast.*—As this report concludes the meteorological year, a brief comparison between the actual seasonal rainfall and the forecast issued in December will be of some interest.

In this forecast it was estimated that the mean rainfall last season over the whole country would be 0.6 in. above normal, whilst actually the mean rainfall as obtained from the 258 stations reported in this *Journal* is 9.14 ins. above normal. Whilst therefore the actual rainfall did not agree so closely with the estimate as at one time appeared probable, yet it is satisfactory to note that the general type of season forecasted, with the exception of an abnormally wet March, was verified by the results.

The discrepancy of 9.14 ins. between the forecast and the actual result was almost wholly due to the heavy rains in March, as the mean rainfall during this month was 7.74 ins. above normal.

This abnormal March was somewhat unexpected, as, owing (1) to the early commencement of the rainy season at the beginning of October, and (2) the break between the rains occurring two weeks earlier than usual during the period 6th to 17th December, it was thought that the season would end early.

There was a slight break in the general rains during the period 17th to 22nd February, but after that date heavy rain was general till the end of March, with the equatorial low pressure area persisting throughout the month. In this connection it is interesting to note that in the Weather Report for February in the Union of South Africa it is stated that "the most noticeable feature during the month was the persistence of the equatorial low pressure area, which frequently lay well to westward, on most occasions reaching the coast." Whilst in the March report it is stated that "the equatorial low pressure area, although present during the greater part of the month, was not so strongly developed as during February, whilst there was also a falling off in intensity during the latter half of the month."

It is to be noted that the discrepancy between the estimate and the actual rainfall experienced this year is not abnormally high, as shown in the following schedule, which has been prepared from Table II. in the article in the *Rhodesia Agricultural Journal* for December, 1922:—

| Season. | Deviation of<br>actual mean<br>rainfall from<br>forecast.<br>Inches. | Remarks.                                                 |
|---------|----------------------------------------------------------------------|----------------------------------------------------------|
| 1903-04 | + 0.6                                                                |                                                          |
| 1904-05 | - 5.9                                                                |                                                          |
| 1905-06 | - 0.7                                                                |                                                          |
| 1906-07 | + 3.0                                                                |                                                          |
| 1907-08 | + 3.9                                                                |                                                          |
| 1908-09 | - 1.5                                                                |                                                          |
| 1909-10 | - 9.9                                                                | Above normal season forecast ; below normal experienced. |
| 1910-11 | + 3.9                                                                |                                                          |
| 1911-12 | - 8.0                                                                |                                                          |
| 1912-13 | - 4.3                                                                | Above normal season forecast ; below normal experienced. |
| 1913-14 | - 1.0                                                                |                                                          |
| 1914-15 | + 13.4                                                               |                                                          |
| 1915-16 | - 6.1                                                                |                                                          |
| 1916-17 | - 9.4                                                                | Above normal season forecast ; below normal experienced. |
| 1917-18 | + 11.7                                                               |                                                          |
| 1918-19 | + 7.8                                                                | Below normal season forecast ; above normal experienced. |
| 1919-20 | + 0.8                                                                |                                                          |
| 1920-21 | + 3.7                                                                |                                                          |
| 1921-22 | - 6.6                                                                |                                                          |
| 1922-23 | + 9.1                                                                |                                                          |

All that can be expected at present from this type of forecast is an estimate as to whether the season is likely to be above or below normal. Such an estimate is claimed to be of value from the point of view of general crop conditions throughout the Territory, although in certain years there may be a considerable divergence from the actual figure arrived at as shown above.

It is intended to issue a seasonal forecast for the coming season, and it is hoped to replace the factor of the mean Rhodesian rainfall four seasons previous by a more satisfactory factor, as this factor is the weakest one in the present equation.

## RAINFALL.

| STATION.            | 1923. |       | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|---------------------|-------|-------|-------------------------------|--------------------------------------------|
|                     | May.  | June. |                               |                                            |
| ZONE A.:            |       |       |                               |                                            |
| Bubi—               |       |       |                               |                                            |
| Imbesu Kraal ...    | 0.03  | —     | 34.04                         | 24.05                                      |
| Inyati ...          | —     | —     | 29.97                         | 23.88                                      |
| Maria Farm ...      | —     | —     | 31.42                         | n.s.                                       |
| Shangani Estate ... | —     | —     | 34.83                         | 22.76                                      |
| Bulalima—           |       |       |                               |                                            |
| Kalaka ...          | —     | —     | 31.60                         | 22.16                                      |
| Riverbank ...       | 0.02  | —     | 23.32                         | 23.28                                      |
| Bulawayo—           |       |       |                               |                                            |
| Fairview Farm ...   | 0.06  | —     | 36.72                         | 22.61                                      |
| Keendale ...        | 0.04  | —     | 30.05                         | 20.88                                      |
| Lower Rangemore ... | —     | —     | 38.16                         | 23.78                                      |
| Observatory ...     | 0.06  | —     | 35.21                         | 23.60                                      |
| Gwelo—              |       |       |                               |                                            |
| Dawn ...            | —     | —     | 35.36                         | 26.47                                      |
| Somerset Estate ... | —     | —     | 33.23                         | 24.59                                      |
| Insiza—             |       |       |                               |                                            |
| Thornville ...      | —     | —     | 31.11                         | 26.29                                      |
| Nyamandhlovu—       |       |       |                               |                                            |
| Gwaai Reserve ...   | 0.02  | —     | 42.10                         | n.s.                                       |
| Impondeni ...       | —     | —     | 33.73                         | n.s.                                       |
| Naseby ...          | —     | —     | 32.85                         | 23.68                                      |
| Paddy's Valley ...  | —     | —     | 34.69                         | 23.50                                      |
| Wankie—             |       |       |                               |                                            |
| Lynwood ...         | —     | —     | 21.12                         | 28.39                                      |
| Waterford ...       | 0.02  | —     | 34.57                         | n.s.                                       |
| Sebungwe—           |       |       |                               |                                            |
| Gokwe ...           | —     | —     | 36.99                         | 30.02                                      |
| ZONE B.:            |       |       |                               |                                            |
| Belingwe—           |       |       |                               |                                            |
| Bickwell ...        | 0.16  | —     | 32.47                         | 21.24                                      |
| Bubje Ranch ...     | —     | —     | 22.73                         | n.s.                                       |
| Bulalima—           |       |       |                               |                                            |
| Edwinton ...        | —     | —     | 29.67                         | 21.47                                      |
| Garth ...           | —     | —     | 26.87                         | 25.60                                      |
| Maholi ...          | —     | —     | ...                           | 26.21                                      |
| Retreat ...         | 0.01  | —     | 27.86                         | 20.82                                      |
| Sandown ...         | —     | —     | 33.97                         | n.s.                                       |
| Tjompantie ...      | —     | —     | 26.20                         | 24.01                                      |
| Gwanda—             |       |       |                               |                                            |
| Gwanda Gaol ...     | —     | —     | 27.56                         | 20.44                                      |
| Insindini ...       | —     | —     | ...                           | n.s.                                       |
| Limpopo ...         | 0.05  | —     | 20.73                         | n.s.                                       |
| Tuli ...            | 0.26  | —     | 16.37                         | 14.69                                      |
| Insiza—             |       |       |                               |                                            |
| Albany ...          | 0.09  | —     | 34.13                         | 20.87                                      |
| Filabusi ...        | —     | —     | 25.90                         | 21.33                                      |
| Fort Rixon ...      | —     | —     | 33.80                         | 21.69                                      |
| Infiningwe ...      | —     | —     | 43.13                         | 25.63                                      |
| Lancaster ...       | —     | —     | 35.72                         | n.s.                                       |

## RAINFALL—(Continued).

| STATION.                   | 1923. |       | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|----------------------------|-------|-------|-------------------------------|--------------------------------------------|
|                            | May.  | June. |                               |                                            |
| ZONE B.—(Continued)        |       |       |                               |                                            |
| Matobo—                    |       |       |                               |                                            |
| Holly's Hope ...           | —     | —     | 24.33                         | 22.27                                      |
| Matopo Mission ...         | —     | —     | 36.10                         | 26.16                                      |
| Mtshabezi Mission ...      | 0.01  | —     | 30.52                         | 22.62                                      |
| Rhodes Matopo Park ...     | 0.02  | —     | 36.94                         | 23.12                                      |
| Umfula ...                 | 0.02  | —     | 27.16                         | n.s.                                       |
| Umzingwane—                |       |       |                               |                                            |
| Essexvale ...              | 0.02  | —     | 41.13                         | 23.94                                      |
| Kodhwayo ...               | —     | —     | 31.87                         | n.s.                                       |
| ZONE C.:                   |       |       |                               |                                            |
| Charter—                   |       |       |                               |                                            |
| Bushy Park ...             | —     | —     | 47.40                         | 26.44                                      |
| Enkeldoorn ...             | 0.08  | —     | 35.54                         | 29.18                                      |
| Marshbrook ...             | 0.12  | —     | 33.96                         | 29.32                                      |
| Range ...                  | —     | —     | 42.97                         | 31.29                                      |
| Umnati ...                 | —     | —     | 30.71                         | 23.50                                      |
| Vrede ...                  | —     | —     | 42.00                         | 28.87                                      |
| Chilimanzi—                |       |       |                               |                                            |
| Allanberry ...             | 0.12  | 0.02  | 38.16                         | 25.75                                      |
| Central Estates ...        | —     | —     | 40.34                         | 28.62                                      |
| Gwelo—                     |       |       |                               |                                            |
| Cross Roads ...            | —     | —     | 36.62                         | 25.22                                      |
| East Clare Ranch ...       | —     | —     | 30.47                         | n.s.                                       |
| Globe and Phoenix Mine ... | —     | —     | 34.73                         | 29.04                                      |
| Gwelo Gaol ...             | —     | —     | 42.41                         | 26.25                                      |
| Indiva ...                 | —     | —     | 40.43                         | n.s.                                       |
| Lyndene ...                | —     | —     | 38.08                         | n.s.                                       |
| Rhodesdale Ranch ...       | —     | —     | 38.56                         | 26.25                                      |
| Hartley—                   |       |       |                               |                                            |
| Ardgowan ...               | 0.01  | —     | 44.06                         | 31.02                                      |
| Balwearie ...              | —     | —     | 39.72                         | n.s.                                       |
| Beatrice... ..             | —     | —     | 40.43                         | n.s.                                       |
| Carnock ...                | 0.02  | —     | 44.53                         | 31.49                                      |
| Philiphaugh ...            | 0.21  | —     | 43.04                         | 32.77                                      |
| Cromdale ...               | 0.06  | —     | 41.40                         | n.s.                                       |
| Elvington ...              | —     | —     | 49.41                         | 31.44                                      |
| Gatooma ...                | 0.12  | —     | 40.39                         | 31.48                                      |
| Gowerlands ...             | —     | —     | 42.17                         | 30.21                                      |
| Hallingbury ...            | 0.25  | —     | 37.83                         | 28.24                                      |
| Hartley Gaol ...           | 0.15  | —     | 41.42                         | 32.48                                      |
| Hopewell ...               | —     | —     | 39.22                         | 27.33                                      |
| Jenkinsontown ...          | —     | —     | 40.68                         | 29.73                                      |
| Ranwick ...                | 0.30  | —     | 42.83                         | 28.15                                      |
| Spitzkop ...               | —     | —     | ..                            | 28.74                                      |
| Lomagundi—                 |       |       |                               |                                            |
| Argyle ...                 | —     | —     | 38.54                         | 33.29                                      |
| Baguta ...                 | 0.14  | —     | 54.65                         | 31.47                                      |
| Citrus Estate ...          | —     | —     | 44.49                         | 32.62                                      |
| Darwendale ...             | 0.07  | —     | 38.38                         | 31.15                                      |

## RAINFALL—(Continued).

| STATION.                        | 1923. |       | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|---------------------------------|-------|-------|-------------------------------|--------------------------------------------|
|                                 | May.  | June. |                               |                                            |
| ZONE C.—(Continued)             |       |       |                               |                                            |
| Lomagundi (Continued)—          |       |       |                               |                                            |
| Dingley Dell ...                | ...   | —     | 43.53                         | n.s.                                       |
| Freda ...                       | ...   | —     | 40.40                         | n.s.                                       |
| Gambuli ...                     | 0.61  | —     | 42.67                         | 37.76                                      |
| Gungurubee ...                  | ...   | —     | 39.91                         | n.s.                                       |
| Impingi ...                     | 0.01  | —     | 47.02                         | n.s.                                       |
| Lone Cow Estate ...             | ...   | —     | 44.68                         | 34.10                                      |
| Mafoota ...                     | ...   | —     | 46.74                         | n.s.                                       |
| Maningwa ...                    | ...   | —     | 55.49                         | n.s.                                       |
| Mapandagutu ...                 | ...   | —     | 40.36                         | n.s.                                       |
| Mukwe River Ranch ...           | ...   | —     | 43.30                         | 31.34                                      |
| Nyapi ...                       | ...   | —     | 47.70                         | n.s.                                       |
| Nyaroro ...                     | 0.14  | —     | 46.88                         | n.s.                                       |
| Nyati ...                       | ...   | —     | 40.09                         | n.s.                                       |
| Palm Tree Farm ...              | 0.29  | —     | 36.45                         | 32.68                                      |
| Richmond ...                    | ...   | —     | 44.29                         | n.s.                                       |
| Sangwe ...                      | ...   | —     | 48.38                         | n.s.                                       |
| Silater Estate ...              | ...   | —     | 47.55                         | n.s.                                       |
| Sinoia ...                      | ...   | —     | 47.08                         | 31.51                                      |
| Sipolilo ...                    | ...   | —     | 45.22                         | 31.64                                      |
| Talfourd ...                    | ...   | —     | 46.88                         | 32.67                                      |
| Umboe ...                       | 1.47  | —     | 47.93                         | n.s.                                       |
| Umvukwe Ranch ...               | ...   | —     | 45.10                         | 33.71                                      |
| Salisbury—                      |       |       |                               |                                            |
| Avondale ...                    | 0.20  | —     | 42.96                         | 32.24                                      |
| Botanical Experiment Station... | 1.33  | —     | 42.75                         | 33.41                                      |
| Bromley ...                     | 0.15  | —     | 45.28                         | 34.36                                      |
| Cleveland Dam ...               | 0.49  | —     | 44.22                         | 30.80                                      |
| Gwebi ...                       | 0.08  | —     | 45.90                         | 34.46                                      |
| Hillside ...                    | 0.49  | —     | 43.53                         | 30.57                                      |
| Lilfordia ...                   | 0.70  | —     | 41.15                         | 30.27                                      |
| Lochinvar ...                   | 0.37  | —     | 40.00                         | n.s.                                       |
| Manor Farm ...                  | 0.15  | —     | 47.48                         | n.s.                                       |
| Salisbury Gaol ...              | 0.38  | —     | 45.41                         | 32.13                                      |
| Sebastopol ...                  | —     | —     | 48.37                         | 32.62                                      |
| Selby ...                       | —     | —     | 49.30                         | 29.90                                      |
| Stapleford ...                  | 0.05  | —     | 53.67                         | 33.90                                      |
| Tisbury ...                     | 1.17  | —     | 47.35                         | n.s.                                       |
| Vainona ...                     | 0.23  | —     | 48.04                         | 34.15                                      |
| Sebungwe—                       |       |       |                               |                                            |
| Sikombela ...                   | —     | —     | 37.53                         | 28.61                                      |
| ZONE D. :                       |       |       |                               |                                            |
| Darwin—                         |       |       |                               |                                            |
| La Belle Esperance...           | ...   | —     | 36.42                         | n.s.                                       |
| Mount Darwin ...                | ...   | 0.07  | 39.89                         | 31.36                                      |
| Inyanga—                        |       |       |                               |                                            |
| Inyanga ...                     | ...   | —     | 57.77                         | 37.39                                      |
| Juliasdale ...                  | 1.46  | 0.25  | 57.87                         | n.s.                                       |
| Rhodes Estate ...               | ...   | —     | 47.86                         | 36.59                                      |
| York ...                        | 0.06  | 0.09  | 47.52                         |                                            |



## RAINFALL—(Continued).

| STATION.                      | 1923. |       | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|-------------------------------|-------|-------|-------------------------------|--------------------------------------------|
|                               | May.  | June. |                               |                                            |
| ZONE D (Continued)            |       |       |                               |                                            |
| Makoni—                       |       |       |                               |                                            |
| Eagle's Nest ... ..           | —     | 0.30  | 50.03                         | 33.19                                      |
| Forest Hill ... ..            | 0.47  | —     | 40.12                         | 37.76                                      |
| Riversdale... ..              | —     | —     | 49.28                         | n.s.                                       |
| Wensleydale ... ..            | —     | —     | 53.01                         | n.s.                                       |
| Marandellas—                  |       |       |                               |                                            |
| Rastenburg ... ..             | —     | —     | 53.16                         | n.s.                                       |
| Mazoe—                        |       |       |                               |                                            |
| Atherstone ... ..             | —     | —     | 47.96                         | n.s.                                       |
| Avonduur ... ..               | —     | —     | 50.73                         | 33.53                                      |
| Benridge ... ..               | —     | —     | 43.99                         | 34.96                                      |
| Bindura ... ..                | 0.06  | —     | 49.46                         | 35.55                                      |
| Ceres ... ..                  | 0.49  | —     | 56.36                         | 38.82                                      |
| Chipoli ... ..                | —     | —     | 43.14                         | 34.98                                      |
| Citrus Estate ... ..          | 0.15  | 0.04  | 45.45                         | 32.62                                      |
| Craigengower ... ..           | 0.09  | —     | 50.23                         | 36.09                                      |
| Glen Divis ... ..             | 0.09  | —     | 52.61                         | n.s.                                       |
| Great B ... ..                | 0.62  | —     | 47.45                         | n.s.                                       |
| Kilmer ... ..                 | —     | —     | 47.97                         | 35.91                                      |
| Kingston ... ..               | 0.17  | 0.02  | 55.80                         | 37.58                                      |
| Mazoe ... ..                  | 0.18  | —     | 43.99                         | 33.00                                      |
| Marienzi ... ..               | 0.06  | —     | 36.82                         | n.s.                                       |
| Marston... ..                 | —     | —     | 40.01                         | n.s.                                       |
| Mgutu ... ..                  | 0.18  | —     | 50.81                         | 29.64                                      |
| Omeath ... ..                 | 0.04  | —     | 47.91                         | 32.42                                      |
| Pearson Settlement ... ..     | —     | —     | 49.61                         | n.s.                                       |
| Ruia ... ..                   | 0.06  | —     | 47.17                         | 39.51                                      |
| Ruoko Ranch ... ..            | 0.40  | —     | 46.15                         | 33.54                                      |
| Shamva ... ..                 | —     | —     | 43.11                         | 34.99                                      |
| Stanley Kop ... ..            | 0.14  | —     | 43.84                         | 31.28                                      |
| Sunnyside ... ..              | 0.11  | —     | 50.06                         | 34.59                                      |
| Teign ... ..                  | —     | —     | 45.46                         | 36.19                                      |
| Usk ... ..                    | 0.04  | —     | 61.27                         | n.s.                                       |
| Virginia ... ..               | —     | —     | 55.94                         | 31.54                                      |
| Visa ... ..                   | —     | —     | 48.01                         | n.s.                                       |
| Woodlands ... ..              | 0.90  | —     | 56.16                         | n.s.                                       |
| Zombi ... ..                  | 0.13  | —     | 49.48                         | n.s.                                       |
| Mrewa—                        |       |       |                               |                                            |
| Glen Somerset ... ..          | 0.08  | —     | 44.29                         | 35.90                                      |
| Mrewa ... ..                  | 0.04  | —     | 57.22                         | 35.46                                      |
| Selous Nek ... ..             | —     | —     | 49.02                         | 34.93                                      |
| Mtoko—                        |       |       |                               |                                            |
| Makaha ... ..                 | —     | —     | 43.30                         | 37.88                                      |
| Mtoko ... ..                  | —     | —     | 34.10                         | 29.04                                      |
| Salisbury—                    |       |       |                               |                                            |
| Arcturus ... ..               | 0.17  | —     | 55.67                         | n.s.                                       |
| Chindamora Reserve ... ..     | 0.33  | —     | 47.96                         | n.s.                                       |
| Glenara ... ..                | —     | —     | 45.41                         | 31.62                                      |
| Goromonzi ... ..              | 0.10  | —     | 52.18                         | 39.07                                      |
| Hatcliffe (Borrowdale) ... .. | 0.40  | —     | 51.02                         | 35.35                                      |
| Hillside (Bromley) ... ..     | 0.13  | —     | 43.98                         | n.s.                                       |

## RAINFALL—(Continued).

| STATION.               | 1923. |       | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |       |       |
|------------------------|-------|-------|-------------------------------|--------------------------------------------|-------|-------|
|                        | May.  | June. |                               |                                            |       |       |
| ZONE D.—(Continued)    |       |       |                               |                                            |       |       |
| Salisbury (Continued)— |       |       |                               |                                            |       |       |
| Kilmuir ...            | ...   | ...   | 0.06                          | —                                          | 51.59 | n.s.  |
| Meadows ...            | ...   | ...   | 0.10                          | —                                          | 59.48 | 40.07 |
| Springs ...            | ...   | ...   | 0.22                          | —                                          | 51.42 | n.s.  |
| ZONE E. :              |       |       |                               |                                            |       |       |
| Belingwe—              |       |       |                               |                                            |       |       |
| Belingwe ...           | ...   | ...   | —                             | —                                          | 30.89 | n.s.  |
| Inferno Ranch ...      | ...   | ...   | —                             | —                                          | ...   | n.s.  |
| Shabani ...            | ...   | ...   | —                             | —                                          | 36.23 | n.s.  |
| Bikita—                |       |       |                               |                                            |       |       |
| Angus Ranch ...        | ...   | ...   | 0.02                          | 0.24                                       | 36.95 | n.s.  |
| Bikita ...             | ...   | ...   | 2.50                          | —                                          | 75.78 | 61.47 |
| Devuli Ranch ...       | ...   | ...   | —                             | —                                          | 24.50 | n.s.  |
| Charter—               |       |       |                               |                                            |       |       |
| Buhera ...             | ...   | ...   | 0.15                          | 0.07                                       | 42.06 | 30.15 |
| Riversdale ...         | ...   | ...   | —                             | —                                          | 42.56 | 28.69 |
| Chibi—                 |       |       |                               |                                            |       |       |
| Chibi ...              | ...   | ...   | 0.16                          | —                                          | 33.89 | 25.04 |
| Chilimanzi—            |       |       |                               |                                            |       |       |
| Chilimanzi ...         | ...   | ...   | 0.15                          | —                                          | 46.94 | 27.01 |
| Driefontein ...        | ...   | ...   | 0.17                          | 0.05                                       | 39.66 | 27.17 |
| Felixburg ...          | ...   | ...   | —                             | —                                          | 38.83 | 32.40 |
| Grootfontein ...       | ...   | ...   | —                             | —                                          | 38.01 | 27.59 |
| Induna Farm ...        | ...   | ...   | —                             | —                                          | 38.68 | 29.11 |
| Requeza Estate ...     | ...   | ...   | —                             | —                                          | 35.63 | n.s.  |
| Gutu—                  |       |       |                               |                                            |       |       |
| Gutu ...               | ...   | ...   | 0.35                          | —                                          | 36.35 | 30.32 |
| Glenary ...            | ...   | ...   | 0.18                          | 0.03                                       | 29.84 | n.s.  |
| M'vimvi Ranch ...      | ...   | ...   | —                             | —                                          | 44.40 | 28.72 |
| Tel-el-Kebir ...       | ...   | ...   | 0.26                          | —                                          | 48.29 | 29.66 |
| Gwelo—                 |       |       |                               |                                            |       |       |
| Lover's Walk ...       | ...   | ...   | —                             | —                                          | 36.35 | 25.48 |
| Safago ...             | ...   | ...   | 0.36                          | —                                          | 45.54 | 30.77 |
| Partridge Farm ...     | ...   | ...   | 0.29                          | —                                          | 47.70 | n.s.  |
| Sheep Run Farm ...     | ...   | ...   | —                             | —                                          | 44.89 | n.s.  |
| Insiza—                |       |       |                               |                                            |       |       |
| Rooddeheuvel ...       | ...   | ...   | —                             | —                                          | 28.16 | 28.83 |
| Inyanga—               |       |       |                               |                                            |       |       |
| St. Trias' Hill ...    | ...   | ...   | —                             | —                                          | 47.02 | 40.14 |
| Makoni—                |       |       |                               |                                            |       |       |
| Chitora ...            | ...   | ...   | 0.07                          | —                                          | 48.11 | 35.32 |
| Craigendoran ...       | ...   | ...   | 0.91                          | —                                          | 47.73 | 30.94 |
| Gorubi Springs ...     | ...   | ...   | 0.29                          | —                                          | 42.42 | 38.11 |
| Mona ...               | ...   | ...   | 0.06                          | 0.11                                       | 43.24 | 35.05 |
| Monte Cassino ...      | ...   | ...   | 0.37                          | —                                          | 50.49 | 35.34 |
| Rusape ...             | ...   | ...   | 0.33                          | —                                          | 34.34 | 32.66 |
| Springs ...            | ...   | ...   | —                             | —                                          | 43.24 | 37.27 |
| Marandellas—           |       |       |                               |                                            |       |       |
| Bonongwe ...           | ...   | ...   | 0.22                          | —                                          | 42.69 | 31.16 |
| Delta ...              | ...   | ...   | —                             | —                                          | 42.76 | 36.46 |

## RAINFALL—(Continued).

| STATION.                    | 1923. |       | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|-----------------------------|-------|-------|-------------------------------|--------------------------------------------|
|                             | May.  | June. |                               |                                            |
| Zone E.—(Continued)         |       |       |                               |                                            |
| Marandellas (Continued)—    |       |       |                               |                                            |
| Igudu ...                   | —     | —     | 36.35                         | n.s.                                       |
| Land Settlement ...         | 0.23  | —     | 45.28                         | 32.94                                      |
| Lendy Estates ...           | —     | —     | 44.87                         | n.s.                                       |
| Marandellas ...             | 0.22  | —     | 57.99                         | 36.97                                      |
| Nelson ...                  | —     | —     | 35.27                         | 30.60                                      |
| Tweedjan ...                | 0.21  | —     | 40.24                         | 36.65                                      |
| White Gambolo Ranch ...     | 0.29  | —     | 43.44                         | n.s.                                       |
| Melsetter—                  |       |       |                               |                                            |
| Brackenbury ...             | 1.02  | —     | 64.88                         | 52.17                                      |
| Tom's Hope ...              | 0.25  | 1.02  | 67.02                         | 47.21                                      |
| Ndanga—                     |       |       |                               |                                            |
| Doornfontein ...            | 0.77  | 0.07  | 42.57                         | n.s.                                       |
| Ndanga... ..                | 0.88  | —     | 53.68                         | 43.32                                      |
| Triangle Ranch ...          | —     | —     | 34.63                         | n.s.                                       |
| Selukwe—                    |       |       |                               |                                            |
| Aberfoyle Ranch ...         | 0.30  | —     | 46.83                         | 31.81                                      |
| Hillingdon ...              | 0.44  | —     | 47.77                         | 31.77                                      |
| Impali Source ...           | —     | —     | 44.69                         | n.s.                                       |
| Rio ...                     | 0.30  | —     | 47.56                         | 29.14                                      |
| Umtali—                     |       |       |                               |                                            |
| Argyll ...                  | 0.01  | —     | 41.56                         | 33.25                                      |
| Gilmerton ...               | 0.14  | —     | 40.37                         | 31.39                                      |
| Jerain ...                  | —     | —     | 40.23                         | 33.00                                      |
| Mutambara Mission ...       | 0.09  | —     | 42.16                         | 29.40                                      |
| Odzani Power Station ...    | 0.67  | 0.05  | 52.16                         | 36.04                                      |
| Park Farm ...               | 1.67  | 0.44  | 74.51                         | n.s.                                       |
| Premier Estate ...          | 0.05  | 0.02  | 45.34                         | 29.84                                      |
| Sarum ...                   | —     | —     | 50.34                         | 33.40                                      |
| Stapleford ...              | 1.99  | —     | 87.28                         | 64.10                                      |
| St. Augustine's Mission ... | 0.72  | 0.52  | 55.10                         | n.s.                                       |
| Umtali (Gaol) ...           | 0.30  | 0.25  | 53.00                         | 31.90                                      |
| Victoria—                   |       |       |                               |                                            |
| Brucehame ...               | 0.64  | —     | 36.19                         | 26.69                                      |
| Cambria ...                 | 0.45  | —     | 32.26                         | n.s.                                       |
| Chevenden ...               | 0.91  | 0.05  | 46.65                         | n.s.                                       |
| Clipsham ...                | 0.28  | —     | 23.67                         | 29.12                                      |
| Glenlivet ...               | 1.17  | —     | 57.39                         | n.s.                                       |
| Gokomere ...                | 0.28  | 0.02  | 43.71                         | 26.17                                      |
| Histonhurst ...             | —     | —     | 40.69                         | n.s.                                       |
| Makahori Farm ...           | —     | —     | 38.14                         | n.s.                                       |
| Makorsi River Ranch ...     | 0.21  | 0.23  | 46.55                         | 33.61                                      |
| Mashaba ...                 | 0.53  | —     | 39.25                         | n.s.                                       |
| Morgenster Mission ...      | 1.87  | 0.30  | 64.22                         | 40.99                                      |
| M'Sali ...                  | 0.55  | —     | 29.65                         | n.s.                                       |
| Riverdene North ...         | 0.67  | —     | 40.32                         | n.s.                                       |
| Salemore ...                | 0.30  | —     | 40.08                         | n.s.                                       |
| Silver Oaks ...             | 0.32  | —     | 31.19                         | 28.84                                      |

## RAINFALL—(Continued).

| STATION.              |     |     |      | 1923. |       | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|-----------------------|-----|-----|------|-------|-------|-------------------------------|--------------------------------------------|
|                       |     |     |      | May.  | June. |                               |                                            |
| ZONE E.—(Continued)   |     |     |      |       |       |                               |                                            |
| Victoria (Continued)— |     |     |      |       |       |                               |                                            |
| Stanmore              | ... | ... | 0.06 | —     | 42.15 | n.s.                          |                                            |
| Summerton             | ... | ... | —    | —     | 27.23 | 25.55                         |                                            |
| Tewkesbury            | ... | ... | —    | —     | 40.19 | n.s.                          |                                            |
| Tichidza              | ... | ... | 0.91 | 0.22  | 61.51 | 35.55                         |                                            |
| Victoria              | ... | ... | 0.10 | —     | 30.01 | 26.46                         |                                            |
| Zimbabwe              | ... | ... | 0.52 | —     | 43.89 | n.s.                          |                                            |
| ZONE F.:              |     |     |      |       |       |                               |                                            |
| Melsetter—            |     |     |      |       |       |                               |                                            |
| Chikore               | ... | ... | 1.32 | —     | 61.40 | 47.70                         |                                            |
| Chipinga              | ... | ... | 1.15 | —     | 60.69 | 48.37                         |                                            |
| Melsetter             | ... | ... | 0.04 | 0.34  | 52.81 | 46.11                         |                                            |
| Mount Selinda         | ... | ... | 2.01 | —     | 64.79 | 68.67                         |                                            |
| Vermont               | ... | ... | 1.97 | —     | 85.80 | 66.36                         |                                            |
| Umtali—               |     |     |      |       |       |                               |                                            |
| Hoboken               | ... | ... | —    | —     | 84.75 | 59.24                         |                                            |

— means nil.

... means no return.

# Dates of Meetings of Farmers' Associations, Southern Rhodesia

(SUBJECT TO ALTERATION)

| Name of Association                   | Place of Meeting                              | Secretary              | 1923   |           |         |
|---------------------------------------|-----------------------------------------------|------------------------|--------|-----------|---------|
|                                       |                                               |                        | August | September | October |
| Banket Junction ..                    | Banket Hotel                                  | G. S. Laffer ..        | 4      | 27        | 6       |
| Beaufort District ..                  | Beaufort Hall, Beaufort                       | W. K. Ashby ..         | 20     | 27        | 26      |
| Bromley ..                            | Bromley                                       | G. J. Ashby ..         | 2      | 6         | 4       |
| Darwin ..                             | Arandia Farm & M. L. Darwin Store alternately | G. J. Shirley ..       | No     | fixed     | ..      |
| Eastern Border (South Melssetter)     | Farm Ravenswood                               | J. W. Goucher ..       | ..     | ..        | ..      |
| Eastern Districts ..                  | Farmers' Hall, Chitiza ..                     | J. Radney ..           | 11     | 8         | 13      |
| Enkeldoorn ..                         | Enkeldoorn Hotel                              | Geo. Bully ..          | 2      | 6         | 4       |
| Farmer's Gate ..                      | Farmer's Gate Hotel                           | J. E. Adcock ..        | 11     | 8         | 13      |
| Figtree Branch, R. L. and P. A.       | Figtree Branch, Figtree, Aug. & Guita         | A. S. Will ..          | 2      | 6         | ..      |
| Gabazi ..                             | Figtree Hotel                                 | E. Kelsey-Harvey ..    | No     | fixed     | dates   |
| Gatooma ..                            | Speck's Hotel                                 | A. Seale ..            | 18     | 15        | 20      |
| Gazaland ..                           | Clippinga Court House ..                      | James Ward ..          | ..     | 6         | ..      |
| Greystone ..                          | Various farm houses, Shangani                 | M. C. Verduyn ..       | ..     | 17        | ..      |
| Hartbees ..                           | Rocky Ridge, Gwanda ..                        | M. C. Verduyn ..       | 25     | 22        | 27      |
| Headlands ..                          | Headlands Station                             | J. de L. Ntshamo ..    | ..     | 21        | ..      |
| Hunter's Road Farmers and Stockowners | Hunter's Road Station                         | J. Grevar ..           | No     | fixed     | dates   |
| Insiza—Shangani ..                    | Hunter's Road Station                         | R. W. Twilley ..       | 11     | 8         | 13      |
| Insiza South ..                       | Shangani                                      | M. E. Weale ..         | ..     | ..        | ..      |
| Inyanga ..                            | Lancaster                                     | J. Campbell ..         | 8      | 12        | 10      |
| Isiyazura ..                          | Rhodes Inyanga Estate                         | E. J. Backing ..       | 20     | 17        | 15      |
| Leopards ..                           | Leopards                                      | J. F. Pherlin ..       | 3      | 7         | 5       |
| Lenagundi ..                          | Siola                                         | F. W. Robertson ..     | No     | fixed     | ..      |
| Makwiro ..                            | Makwiro                                       | W. L. McLean ..        | 17     | 21        | 19      |
| Makoni North ..                       | Makoni South Farm                             | James G. Dickson ..    | 29     | 26        | 31      |
| Makoni ..                             | Makoni                                        | J. G. Monckton ..      | 11     | 8         | 13      |
| Marandellas Northern                  | Marandellas Farmers' Hall                     | Lionel Doherty ..      | ..     | ..        | ..      |
| Marandellas Southern                  | Marandellas                                   | W. F. J. T. Tsonson .. | 1      | 5         | 8       |
| Mashonaland ..                        | Commercial Hotel, Salisbury                   | L. Neake ..            | No     | fixed     | dates   |
| Matopo Branch, R. L. and P. A.        | Holi Farm                                     | W. S. George ..        | 8      | 12        | 10      |
| Mazoe ..                              | Glendale                                      | M. D. Ward ..          | ..     | ..        | ..      |
| Mazoe Central ..                      | Mezoe Hotel                                   | G. Wills ..            | 3      | 7         | 5       |
| Melsetter ..                          | Melsetter                                     | T. O. Willows ..       | 9      | 13        | 11      |
| Melsetter (North) ..                  | Dromler                                       | R. Vordehouse ..       | 21     | 18        | 16      |
| Melsetter Farmers and Stockowners     | Edmore Hotel, Gwelo                           | R. Vordehouse ..       | ..     | ..        | ..      |
| Northern ..                           | Farm Summerfield                              | A. Tulloch ..          | 3      | 7         | 5       |
| Norton and Lyddiate District          | Norton Store                                  | W. Wrench ..           | No     | fixed     | ..      |
| Nyanadhlou ..                         | Nyanadhlou                                    | G. Graham ..           | ..     | ..        | ..      |
| Que Que ..                            | Que Que                                       | E. J. Ross ..          | ..     | ..        | ..      |
| Rhodesian Landowners and Farmers      | Library Buildings, Bulawayo                   | H. S. Hopkins ..       | ..     | ..        | ..      |
| Sekake ..                             | Various farms                                 | G. Douglas ..          | 15     | 15        | 20      |
| Shamva ..                             | Shamva                                        | A. T. Thompson ..      | 16     | 20        | 18      |
| Unvukwe ..                            | Various ranches                               | M. A. A. Bracewell ..  | 11     | 15        | 13      |
| Umtali ..                             | Drill Hall, Umtali                            | J. S. Holland ..       | 2      | 6         | 4       |
| Umvuma District and Stockowners       | Umvuma                                        | M. W. Graham ..        | 31     | 28        | 26      |
| Victoria ..                           | Victoria                                      | W. F. N. Thornton ..   | 3      | 7         | 5       |
| Wankie District ..                    | Wankie                                        | W. E. Cumming ..       | ..     | ..        | ..      |
| Western ..                            | Plumtree Hotel                                | W. E. Goucher ..       | 11     | 8         | 13      |

## RHODESIAN MILK RECORDS TO DATE.

| Name of cow.           | Breed.    | Commenced record. | Milk in lbs. Latest return. | Butter fat in lbs. Latest return. | Milk in lbs. to date. | Butter fat in lbs. to date. | Time from commencement of record. | Name and address of owner.               |
|------------------------|-----------|-------------------|-----------------------------|-----------------------------------|-----------------------|-----------------------------|-----------------------------------|------------------------------------------|
| Pansy IV.*             | Friesland | 6/5/22            | 92                          | ...                               | 7,324                 | ...                         | 364 days                          | C. F. Anthony, Randolph Farm, Gwelo      |
| Ruitge Emma*           | do        | 26/8/22           | 182                         | ...                               | 5,548                 | ...                         | 308 do                            | do do                                    |
| Ruitge Bella           | do        | 29/4/23           | 789                         | ...                               | 1,840                 | ...                         | 63 do                             | do do                                    |
| Banjo ...              | Shorthorn | 9/8/22            | 208.6                       | 10.24                             | 4,266.8               | 174.36                      | 308 do                            | C. G. Cooper, Chambercy, Essexvale       |
| Baby ...               | do        | 4/10/22           | 131.2                       | 7.79                              | 2,991.5               | 140                         | 252 do                            | do do                                    |
| Pepper ...             | do        | 1/11/22           | 318.5                       | 14.01                             | 3,016.3               | 139.14                      | 224 do                            | do do                                    |
| Zaza ...               | do        | 8/12/22           | 195.3                       | 11.27                             | 2,735.9               | 148.93                      | 217 do                            | do do                                    |
| Ann ...                | do        | 20/12/22          | 228.9                       | 12.20                             | 1,878.1               | 96.03                       | 161 do                            | do do                                    |
| Mary ...               | do        | 14/3/23           | 347.9                       | 15.06                             | 1,436.4               | 60.94                       | 91 do                             | do do                                    |
| Mulder's Vlei Juno ... | Friesland | 21/3/23           | 721                         | 26.68                             | 1,792                 | 67.76                       | 70 do                             | Knight & Folkestad, Lochinvar, Salisbury |
| Rivenhill Ceres Ormsby | do        | 4/4/23            | 1,134                       | 35.15                             | 2,114                 | 64.55                       | 53 do                             | do do                                    |
| Brakfontein Klaske II. | do        | 1/5/23            | 1,632                       | 62.77                             | 1,652                 | 62.77                       | 28 do                             | do do                                    |
| Lizzy ...              | Cape Cow  | 4/5/23            | 712                         | 28.48                             | 712                   | 28.48                       | 25 do                             | do do                                    |
| Henrietta ...          | Shorthorn | 24/11/22          | 178.5                       | ...                               | 2,320.5               | ...                         | 196 do                            | R. C. MacLagan, Rusape.                  |
| Spottie ...            | Ayrshire  | do                | 108.5                       | ...                               | 896                   | ...                         | 140 do                            | do do                                    |
| Agnes ...              | Shorthorn | 1/12/22           | 140                         | ...                               | 1,176                 | ...                         | 168 do                            | do do                                    |
| Glady's ...            | Ayrshire  | 2/2/23            | 280                         | ...                               | 1,519                 | ...                         | 126 do                            | do do                                    |
| Lizzie ...             | Shorthorn | 11/5/23           | 184.5                       | ...                               | 184.5                 | ...                         | 28 do                             | do do                                    |
| Maureen*               | Friesland | 13/8/22           | 122.0                       | 4.64                              | 5,192                 | 209.85                      | 273 do                            | J. S. Struthers, Palm Tree, Sinoia       |
| Rosebud ...            | do        | 17/9/22           | 427                         | 22.20                             | 4,080                 | 206.25                      | 287 do                            | do do                                    |
| Bell* ...              | do        | 8/10/22           | 56                          | 2.88                              | 5,562                 | 238.14                      | 238 do                            | do do                                    |

\* These cows have completed their lactation.

N.B.—A gallon of milk weighs approximately 10 lbs.

RHODESIAN MILK RECORDS—*continued.*

| Name of cow.    | Breed.    | Commenced record. | Milk in lbs. Latest return. | Butter fat in lbs. Latest return. | Milk in lbs. to date. | Butter fat in lbs. to date. | Time from commencement of record. | Name and address of owner.         |
|-----------------|-----------|-------------------|-----------------------------|-----------------------------------|-----------------------|-----------------------------|-----------------------------------|------------------------------------|
| Cherry Blossom  | Friesland | 22/11/22          | 602                         | 30.10                             | 4,9.3                 | 258.38                      | 217 days                          | J. S. Struthers, Palm Tree, Simoa. |
| Lacy ...        | do        | 10/12/22          | 489                         | 26.88                             | 4,1.37                | 210.62                      | 203 do                            | do do                              |
| Mollie ...      | do        | 17/12/22          | 538                         | 21.52                             | 4,0.89                | 166.74                      | 196 do                            | do do                              |
| Snowflake ...   | do        | 31/12/22          | 556                         | 23.35                             | 3,4.72                | 141.85                      | 182 do                            | do do                              |
| P. T. Peach ... | do        | 7/1/23            | 602                         | 24.08                             | 4,0.45                | 161.71                      | 175 do                            | do do                              |
| P. T. Lady ...  | do        | do                | 506                         | 20.24                             | 3,2.39                | 136.04                      | 175 do                            | do do                              |
| Corral ...      | do        | 4/3/23            | 1,225                       | 55.13                             | 3,2.94                | 211.46                      | 119 do                            | do do                              |
| Granny ...      | do        | 25/3/23           | 868                         | 39.93                             | 2,6.01                | 121.94                      | 108 do                            | do do                              |

## Departmental Notices.

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The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

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### **BOTANICAL SPECIMENS FOR IDENTIFICATION.**

In all cases where a botanical identification is required it is of the utmost importance that the specimens reach the Department of Agriculture in a thoroughly dry condition, free from mildew, and intact, that is not broken in pieces. Whenever possible specimens should comprise main stem or small branch, leaves, flowers, seed vessels and roots or bulbs, though these need not necessarily be on the same plant.

The colour of the flowers and the general form of the plant should be preserved by pressing and drying between two sheets of blotting paper or newspaper. Ordinary plants not excessively succulent can be dried sufficiently in three days, provided the drying papers are changed every day. A heavy weight should be placed on the specimens in order to press them flat.

Correspondents are asked to supply the following particulars as far as possible:—

- (a) height and general appearance of plant or tree;
- (b) class of soil on which found;
- (c) locality and altitude;
- (d) supposed use or properties.

It is advised that specimens be packed between two sheets of cardboard or thin wood, since in this way they will travel long distances without fear of injury.



### DISTRIBUTION OF SEED FOR CO-OPERATIVE EXPERIMENTS.

It is anticipated that seed of the following summer crops will be available for free distribution under the usual terms of co-operative experiments from 1st August to 31st October. After the latter date no further applications for seed of summer crops can be entertained.

The seed is issued free, but the recipient is required to defray all forwarding and railway charges. Sufficient seed of each kind to sow one-quarter to one-half acre is supplied, and not more than three varieties can be sent to each applicant.

All applications should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury.

*Summer Oats.*—Sixty-day or Kherson.

*Oil Seeds.*—Linseed, sunflower, Spanish bunch ground nuts.

*Legumes.*—White stingless velvet beans, dolichos beans, Sunn hemp, dhal, lupins (for green manure), kudzu vine. Limited quantity of *Stizolobium taborense* (a new velvet bean).

*Hay Crops.*—Teff, Sudan grass, Boer manna, red manna.

*Pasture Grasses.*—Kikuyu, African star, swamp couch, Rhodesian tussock, as referred to in the *Rhodesia Agricultural Journal*, April 1923.

*Miscellaneous Crops.*—Buckwheat, Niger oil (for green manuring) and sweet potato runners.

### TREE PLANTING, 1923-24.

Will planters of 5,000 trees and over please notify their requirements, as far as they are able, for the planting season 1923-24 to the Manager, Forest Nursery, Salisbury?

This will facilitate work in the Nursery, and, by the booking of orders, will ensure the earliest possible attention.

### FARM SEEDS FOR SALE.

The undermentioned seeds grown on the Government experiment farms are offered for sale at the prices quoted. The quantities available are limited. Prices are f.o.r., Salisbury, or f.o.r., the Gwebi experiment farm. Owing to limited supply, the full delivery of any order cannot be guaranteed. Farmers are therefore requested not to enclose cheques until they are advised as to the amount of seed allotted to them. The seed is consigned carriage forward in the case of stations. In the case of sidings, the cost of railage will be notified after despatch. All applications for seed should be addressed to the Chief Agriculturist, Department of Agriculture.

Hickory King, selected, hand-picked—20s. per 100 lbs.  
Salisbury White, selected, hand-picked—20s. per 100 lbs.  
Sunflower, Black Russian, from selected heads—15s. per 100 lbs.  
Linseed, white-flowered—6d. per lb.  
Niger oil—3d. per lb.  
Sunn hemp—3d. per lb.  
Teff grass—6d. per lb.  
Boer manna—4d. per lb.  
Pumpkins—2s. per lb.  
Oats, Kherson, sixty-day—30s. per 100 lbs.  
Sweet potato slips—5s. per sack (approximately 1,000 slips).  
Dolichos beans—25s. per 100 lbs.

## Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

### AGRICULTURE AND CROPS.

- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 218. Useful Measurements for Maize, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 235. Crops unsuitable to Southern Rhodesia conditions, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 285. The Mexican Marigold, by F. Eyles, F.L.S.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 327. Linseed, by C. Mainwaring
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 368. Cotton Culture, by H. W. Taylor, B.Agr.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Virgin Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 378. Calendar of Farm Crop Sowings, by C. Mainwaring.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- No. 394. The Interdependence of Crop Rotation and Mixed Farming, by H. G. Mundy, F.L.S.
- No. 397. The Advantage of Autumn and Early Winter Ploughing, by C. Mainwaring.
- No. 399. Green Manuring and Soil Management, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 403. Florida Beggar Weed, by H. G. Mundy, F.L.S.
- No. 407. Wheat—Extracts from Bulletin No. 22, Victoria, Australia.

- No. 408. The Velvet Bean, by J. A. T. Walters, B.A.  
 No. 416. Grasses of Agricultural Importance in Southern Rhodesia, by H. G. Mundy, F.L.S., G. N. Blackshaw, O.B.E., B.Sc., F.I.C., and E. V. Flack.  
 No. 417. The Ground Nut or Monkey Nut, by C. Mainwaring.  
 No. 422. Improvement of Rhodesian White Maize by Selection, by C. Mainwaring.  
 No. 423. The Common Sunflower, by C. Mainwaring.  
 No. 428. The Sweet Potato, by J. A. T. Walters, B.A.  
 No. 429. Propagation of Kudzu Vine, by H. C. Arnold.  
 No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.  
 No. 445. Production of Maize, by C. Mainwaring.  
 No. 454. The Growing of Potatoes in Southern Rhodesia, by C. Mainwaring.  
 No. 455. White & Yellow Maize, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.  
 No. 456. Legumes in Southern Rhodesia, by J. A. T. Walters.  
 Botanical Specimens for Identification.

#### REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.  
 No. 189. The Manuring of Maize on the Government Experiment Farm, Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.  
 No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.  
 No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.  
 No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.  
 No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.  
 No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.  
 No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.  
 No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.  
 No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.  
 No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.  
 No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.  
 No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.  
 No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.  
 No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-1920.  
 No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.  
 No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.  
 No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.  
 No. 432. Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S.  
 No. 433. Winter Cereal Experiments, 1921, by D. E. McLoughlin.  
 No. 437. Annual Report on Crop Experiments, Gwebi, 1921-22, by H. G. Mundy, F.L.S.  
 No. 440. Annual Report of Experiments, 1921-22, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.

## TOBACCO.

- No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.  
 No. 398. Wildfire and Angular Spot.  
 No. 404. Flue-Curing Tobacco Barns and Packing House (Second Revision),  
 by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.  
 No. 410. Common Mistakes in Growing and Handling Virginia Tobacco,  
 by H. W. Taylor, B.Agr.  
 No. 444. Tobacco Seed Beds, by H. W. Taylor, B.Agr.  
 Handbook of Tobacco Culture for Planters in Southern Rhodesia,  
 price 2s. 6d., post free outside South Africa 3s. 6d.

## STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by  
 Eric A. Nobbs, Ph.D., B.Sc.  
 No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.  
 No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season  
 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood.  
 No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D.,  
 B.Sc., and B. Haslewood, F.S.S.  
 No. 247. Statistical Returns of Crops grown by Europeans in Southern  
 Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D.,  
 B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S.,  
 Statistician.  
 No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A.  
 Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.  
 No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.  
 No. 286. Statistics of Live Stock and Animal Produce for the Year 1917,  
 by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.  
 No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and  
 F. Eyles, F.L.S.  
 No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles,  
 F.L.S.  
 No. 361. Statistics of Live Stock and Animal Produce for the Year 1919,  
 by F. Eyles, F.L.S.  
 No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia,  
 1919-1920, by H. C. K. Fynn.  
 No. 393. Statistics of Live Stock and Animal Produce for 1920, by  
 H. C. K. Fynn.  
 No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia  
 for the season 1920-21, by H. C. K. Fynn.  
 No. 426. Statistics of Live Stock and Animal Products for the year 1921,  
 by H. C. K. Fynn.  
 No. 443. Statistics of Crops Grown by Europeans in Southern Rhodesia  
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- Farming Returns for Income Tax Purposes.

## Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 292 of 1923.]

[13th July, 1923.

### TERMINATION OF SUSPENSION OF CUSTOMS DUTIES ON WHEAT, WHEATEN FLOUR AND WHEATEN MEAL.

IT is hereby notified that His Honour the Administrator has been pleased, in terms of section 5 of the "Spirits Excise and Customs Duties Amending and Extension Ordinance, 1920," to fix the 13th day of July, 1923, as the date for the termination of the suspension of the Customs duties on wheat in the grain, wheaten flour and wheaten meal.

No. 281 of 1923.]

[6th July, 1923.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 107 of 1923, and, in terms of section 17 of Government Notice No. 21 of 1917, to declare the following areas of infection and guard area in lieu thereof:—

#### CHARTER AND CHILIMANZI NATIVE DISTRICTS.

##### (a) *Areas of Infection.*

1. The Wiltshire and Worcestershire Estates.
2. The farm Swartfontein.
3. The farm Chipisa.
4. The farm Mooifontein.
5. An area within a radius of four miles of Mswuna's Kraal, in the Sabi Reserve.
6. The farm Totton.
7. The farm Rooipoort.
8. The farm Stockdale.
9. Mangeni Reserve.
10. Narira Reserve.
11. The farm Spurwing.
12. Nyamazaa Block.
13. Ferreiraton Commonage.
14. The farm Rockydale.
15. The farm Kopje Alleen.
16. The farm Onze Rust.
17. The farm Swindon.
18. The farm Inhoek.
19. An area within a radius of four miles of Bindura's Kraal, in the Sabi Reserve.

HARTLEY, MARANDELLAS, CHARTER, CHILIMANZI AND GUTU  
NATIVE DISTRICTS.(b) *Guard Area.*

An area bounded by and including the farms Mserenge, Glynn, Bucknall, Sunnyside, Vergenoeg, Alpha, Pot Luck: thence down the Sabi River to its junction with the Rumwengi River; thence up the latter to its headwaters; thence in a south-westerly direction to the headwaters of the Nyamhonga River, and down this river to its junction with the Nyadzidza River, and up the latter, the Inyazitza and Nyamatsetse Rivers to the farm Riversdale; thence by and including the farms Riversdale, Welwart, Lionsdale, Silverdale, Geluk, Shasha Fountains, Driefontein A and B, Grootfontein, Mtao, Murchiston, Fairview, Hartebeestefontein, Intete, Chesa, Judæa, Umvuna Commonage and that portion of the Central Estates lying north-east of the Umvuna-Rhodesdale road: thence along the eastern boundaries of the farms Sebakwe, Xmas and Bushy Park; and thence along the boundary of the Charter native district to the farm Werwaching; thence by and including this farm and the farms Wheelerdale, Adam's Rest, Brakveld, Goral, Orangia, Emendo, Georgina, Maas Plein, Xekene, Batcome; thence along the Charter road to the farm first named.

No. 302 of 1923.]

[20th July, 1923.]

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Cattle Cleansing Ordinance, 1918," to direct that where the Chief Veterinary Surgeon or other person authorised by him in writing has, under the provisions of section 7 of the said Ordinance, prescribed a dipping interval of fourteen days, the dipping solution shall contain the equivalent of .24 per centum of arsenious oxide.

No. 298.]

[13th July, 1923.

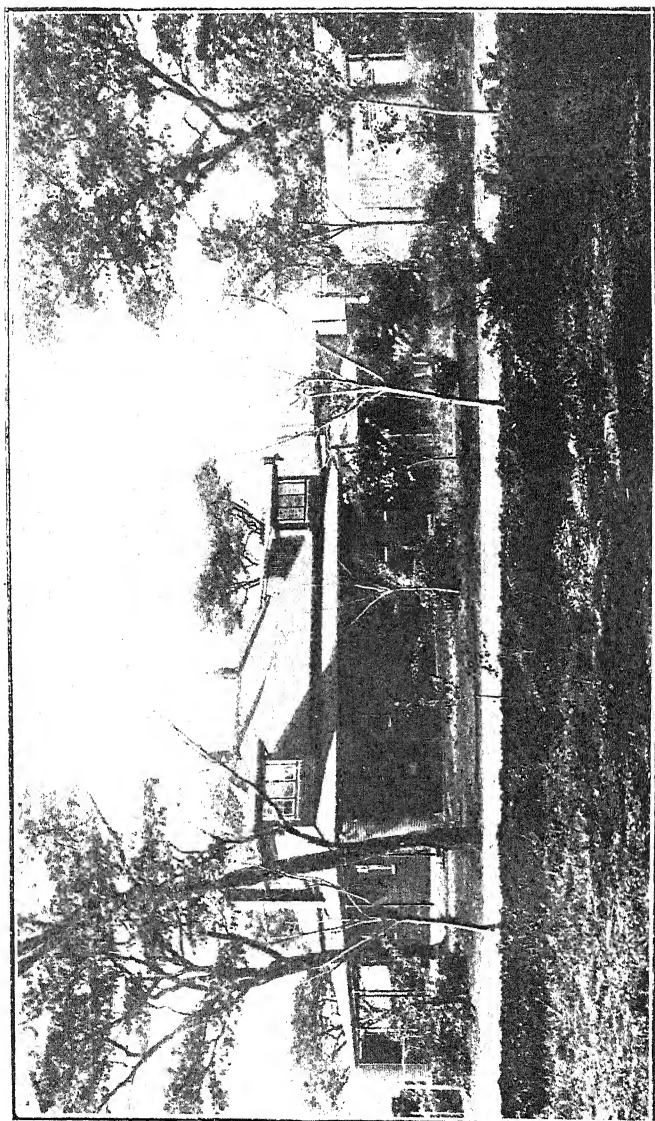
*Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended from time to time.*

IT is hereby notified that the following applications have been made for authority to use water :—

| Name of applicant.                           | Farm.         | Native district of | From what river.                  | Nature of application. | Purpose for which required. | Period for objection |
|----------------------------------------------|---------------|--------------------|-----------------------------------|------------------------|-----------------------------|----------------------|
| A. Sealy-Allin ...                           | Midlands      | Salisbury          | Unnamed tributary of the Makubusi | To divert public water | To irrigate 10 acres        | One month            |
| F. Warner (by consent of the B.S.A. Company) | Sutton Estate | Lomagundi          | Mennemi                           | do                     | To irrigate 20 acres        | do                   |

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 539 of 1922, to lodge, within the period above specified from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections or other representations (if any) to the granting of these applications, together with a full statement of the grounds for such objections or other representations.





The Agricultural Laboratories, Salisbury.

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## Editorial.

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*Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.*

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**Cotton.**—The following letter from Major Cooper, D.S.O., has been received by the Director of Agriculture, and was communicated to the Press:—

“I beg to confirm the statement made by me this morning to yourself and the other gentlemen whom I had the pleasure of meeting as regards the erection of a fully equipped cotton ginnery at Salisbury.

“As the result of enquiries made since my arrival, I am satisfied that a suitable site is procurable. On this site I am prepared to erect a ginnery capable of dealing with from 1,500 to 2,000 lbs. of seed cotton per hour. This should easily meet the requirements of the coming season.

"The charges for ginning and baling cotton, including the necessary hessian and hoop-iron, will not exceed one penny halfpenny (1½d.) per lb. of lint. The disposal of both lint and seed rests with the grower; nevertheless, arrangements have been made that, should the grower so desire, his lint can be sold for him on sample (f.o.r. Salisbury) to cotton buyers in Durban or elsewhere, for which service a small brokerage charge will be made. With regard to seed, what is not required for planting may be sold, on the grower's account, at current market rates.

"Trusting these arrangements may meet with general approval."

The intimation which is given of the establishment of a modern cotton ginnery in Salisbury will, we are sure, be received with great satisfaction by all prospective cotton growers. A good deal of interest is being manifested in Rhodesia in the growing of cotton, and we hear of a number of farmers who intend planting cotton this season. The article which appears in this issue of the *Journal* on the subject will therefore be read with great interest. All who are growing cotton for the first time are advised to read the article carefully and to follow closely the advice given. We understand that Messrs. Allen, Wack & Shepherd, Ltd., are procuring and distributing seed, and that the implement firms are importing cotton planters. We take this opportunity of again urging those who have had no previous experience with cotton to plant in the first instance a limited acreage, and thus to avoid any considerable financial commitment should the crop fail.

Cotton has done well in certain areas of Southern Rhodesia and there is no reason why it should not become a crop of commercial importance. We referred in the April issue of this *Journal* to experiments which were being carried out with cotton last season at the British South Africa Company's estates at Mazoe, Sinoia and Umtali. At Virginia, Mazoe, three varieties were tried, viz., Improved Bancroft, Griffin's and Watt's, in two-acre plots on soil of schist formation. The conditions last season owing to the excessive rains were abnormal, and but small yields were obtained, although the quality of the cotton was excellent. Of the three varieties tried, Improved Bancroft gave the best results. At Sinoia the crop was destroyed by cut-worms, and at the Premier Estate, Umtali, excessive rains adversely affected the yield. The experiments to be of any great value should be continued for a period of years, and it is to be hoped the necessary facilities will be provided.

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**Locusts.**—About the middle of September the presence of locusts was reported on the eastern border. Several swarms appear to have traversed the Chimoia and Manica districts of Portuguese East Africa and thence to have invaded Rhodesia, crossing the Umtali district and entering Makoni, Marandellas and Enkeldoorn. At the present time of the year locusts cannot do much injury to the veld, but if they attack the wheat fields of the districts mentioned, their depredations



are likely to have most serious consequences. At this stage it is not possible to deal satisfactorily with these swarms, the only practical measure being to observe if possible their breeding places and generally to report their movements, so that some idea may be formed of the localities in which hoppers may be expected to appear after the advent of the rains.

We would remind our readers that in terms of the "Locusts Destruction Ordinance, 1918," it is the duty of all persons occupying land in Rhodesia to report to the nearest Magistrate or Police station wherever locusts deposit their eggs or hoppers appear on their land. Arrangements exist under which material for the destruction of hoppers will, wherever necessary, be provided by Government for the use of occupiers of the land whose duty it is to destroy these insects. At the present time natives are busily gathering locusts for food wherever they appear; and providing swarms do not become too numerous, it is possible that this alone may have a material effect in diminishing their numbers before breeding takes place.

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**Dairy Cattle for Nyasaland.**—It is interesting to report that a consignment of Friesland cattle from the well-known herds of Mr. J. S. Struthers and of Mr. F. E. Pickering, Sinoia, has been purchased by a Nyasaland settler for himself and several neighbours. The settlers were offered Friesland cattle from the Union, but preferred to buy animals already acclimatised to conditions similar to those obtaining in Nyasaland.

The consignment consisted of ten animals, headed by Mr. Struthers' pure-bred bull "Zonnenschijn Willem" and four of his sons, whose dams and grand dams have proved themselves good milk producers, and whose milk records have from time to time been published in this *Journal*.

This successful sale is a striking example of the value of keeping milk records, and gives ample proof that both in this colony and in the Union the milk record is the effective salesman.

The animals, before despatch, were subjected to the tuberculin test and declared free from tuberculosis. Every facility was afforded by the Veterinary Department and the Rhodesian Railways for the safe transport of these animals, and it is to be hoped that in their new home they will maintain the reputation which they have so justly earned in the Lomagundi district.

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**Pig Feeding Experiments.**—Mr. E. Salter, of Rockwood, Concession, who gained the championship for a pen of five bacon pigs and also the championship and reserve championship for the pen of three porkers at Salisbury Show, kindly consented, at the request of the dairy expert, to carry out some pig-feeding experiments.

On 11th June, in the presence of the dairy expert, twenty pigs weighing on an average 88 lbs. each were divided into two lots of ten each and placed in separate pens A and B. The pigs in pen A were fed from 11th June to 9th August, a period of sixty days, on a ration, varying as the pigs advanced in weight, of from 4 to 5½ lbs. of the following mixture ground together:—

200 lbs. maize;  
200 lbs. velvet beans;  
80 lbs. ground nuts.

Pumpkins *ad lib.* were fed in the middle of the day. The food was cooked together with pumpkins.

The pigs in pen B got exactly the same ration of grain and pumpkins, but in this case a petrol tin of separated milk (about four gallons) was fed to the pigs daily. On 9th August, in the presence of the dairy expert, the pigs were weighed individually. Some of the pigs in pen B were slightly over 200 lbs., whilst the average was 191 lbs. The pigs in pen A averaged 117 lbs., and had on the average gained only 29 lbs. in 60 days. On the other hand, those in pen B had gained on the average 93 lbs. live weight in 60 days, an average increase of over 1½ lbs. per day, as against less than ½ lb. daily increase in pen A.

This experiment is interesting and bears out the contention that to achieve early maturity in pig raising, separated milk is invaluable as a feed.

It is also interesting to speculate as to the amount of solid feed saved by the feeding of the 240 gallons of separated milk. Assuming that pen A continued to put on an average of half a pound increase live weight per day, it would take this pen exactly 148 days longer to reach the average live weight of pen B. During this time the ten pigs would consume at least 7,400 lbs. of concentrate mixture of maize, beans and monkey nuts, together with a large quantity of pumpkins, etc., and then would be sold at exactly the same price at which pen B was sold. In effect, the feeding of 240 gallons of skim milk worth at most 2d. a gallon (on the farm) resulted in the saving of almost 8,000 lbs. of concentrate mixture worth at least £20 (valuing maize at 6s., velvet beans at 15s. and ground nuts at 6s. a bag). The risk of one or more pigs dying during the extra 148 days required for their maturity was also eliminated.

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**British Empire Exhibition.**—It has been definitely decided that Southern Rhodesia is to be represented at the British Empire Exhibition, to be held at Wembley Park, near London, next year. It will be recollected that £10,000 was voted by the Legislative Council to defray expenses, but that subsequently this amount has been considered insufficient for the purpose. The position now is that endeavours are being made to supplement the grant by public subscriptions. Committees have been elected by representative meetings held at Bulawayo and Salisbury, and we understand it is the intention to concentrate

mineral exhibits at Bulawayo and agricultural exhibits at Salisbury. Space amounting to 5,000 feet has been allotted to Rhodesia in the Union pavilion, and every endeavour is being made to make the display as effective as possible. Donations of grain, produce and agricultural exhibits, as well as articles of interest for the purpose of exhibition, will be gratefully received by the Department of Agriculture and stored until such time as they are sent to England.

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**Revision of Railway Rates.**—The general revision of rates and classification over the Beira and Mashonaland and Rhodesia Railways which took effect from 1st October involves material reductions in the rates for various agricultural commodities and live stock. Thus, the rate on fencing material from Beira to Salisbury has been reduced from 3s. 5d. per 100 lbs. to 1s. 8d. per 100 lbs. The rate on fertilisers from Beira to Salisbury is now 197 pence a ton as against 296 pence formerly; from Natal the rate for fertilisers has been reduced from 64s. a ton to 53s. 11d., and from the Cape from 66s. to 56s. 2d. The rate on salt from one point in the Union has been reduced from £5 7s. 9d. a ton to £3 9s., and from another point from £4 15s. 1d. to £2 13s. 9d. The existing export rates for maize and maize meal *via* Beira and to the Union remain unaltered, but for other descriptions of agricultural produce low export rates both overseas and to the Union are being granted, and the local rates also for this traffic are being brought down to a much lower level. The rates on live stock remain the same for distances up to 500 miles, but for each ten miles beyond 500 miles the rate is 2s. instead of 4s. The reductions amount to £5 18s. per short truck between Bulawayo and the Congo border, and £3 per short truck between Salisbury and Mafeking.

These adjustments will afford a certain amount of relief in these times of stress, and will, we are sure, be much appreciated by the farming community.

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**The Maize Association.**—At the annual general meeting of the Maize Breeders' Association, held in Salisbury on the 13th September, the President, Mr. A. R. Morkel, commented upon the lack of support accorded the executive by members. This support was, he said, absolutely necessary if the association was to continue. Ten points were mentioned by Mr. Morkel as being of the greatest importance to maize growers, viz., railway rates, maize grading, seed selection, implements, production costs, fertilisers, marketing of maize, the existence of the association, yellow maize taint and co-operation.

The President dealt with each item in turn, and in his remarks urged members to give these matters their earnest consideration. He also drew attention to the fact that members had failed to render returns in regard to matters upon which information was desired, such as costs of production, etc. The discussion which followed showed that there had been some misunderstanding on the part of members as to

the nature of the information required, and it was decided to request the executive to submit fresh proposals at a meeting to be convened later.

After the discussion of a lengthy agenda the following office-bearers were elected for the coming year: President, Mr. A. R. Morkel; vice-presidents, Messrs. Mossop and F. C. Peek; committee, Messrs. E. S. White, A. Curling, J. Richardson, G. Rattray, B. Christian, J. H. Farmer, H. Kneiser and V. W. Fynn.

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**The Stall Feeding of Cattle.**—The practice of fattening oxen during the winter season by stall feeding is steadily growing in Rhodesia, and promises to become more general. At the Bulawayo Show this year the entries of slaughter stock numbered 110, and at Salisbury 155. Some of these animals were not as well finished as they might have been, but there were many which were marketed in prime condition and were sold at good prices. Amongst the more prominent feeders of slaughter cattle during the present season we may mention Messrs. D. Black, J. Dawson, C. C. Macarthur, J. R. Stewart, J. Brebner, C. S. Jobling, L. Glanfield, J. Halliday, J. W. Palmer, A. Coles, H. Daws, H. R. Cumming, J. Meikle, E. M. Webber, R. W. Evans, N. W. Eastwood, W. B. Richards, Dr. N. J. Worthington and Messrs. Roberts and Letts, also the Trevelloe Estates, B.S.A. Company, Willoughby's Consolidated, Ltd., and the Farm Lands of Rhodesia, Ltd.

At the Government experiment farm at Gwebi, experiment No. 14 is now in progress, work along these lines having been commenced in 1915, since when 369 head have been dealt with. The procedure is now more or less stereotyped, and the results to be expected can be calculated with a certain degree of accuracy. Profits have fallen, but still to-day the stall feeding of stock is the best way of disposing of cattle and crops which are not otherwise marketable.

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**Weather Forecasts.**—During last rainy season, weather reports were received daily in the meteorological office from stations in this Territory, the Union of South Africa, Beira, and Zomba, Nyasaland. Weather maps were prepared from these reports and a daily forecast issued at noon giving the probabilities for the succeeding 24 hours and a further outlook of general weather probabilities for an additional 24 hours.

These forecasts were telegraphed to certain centres where the farmers had expressed a desire to be supplied with them.

During the coming rainy season, weather reports will be received daily from Mauritius, Seychelles, and coast stations in Portuguese East Africa from Mozambique to Lourenço Marques in addition to the above localities. A daily summary of weather conditions and a limited period forecast will be issued from 1st November onwards, which will be telegraphed to any Post Office if persons interested

notify the Meteorological Office, Department of Agriculture, that they wish to receive these forecasts, which are particularly intended to assist tobacco growers in the critical operation of planting out from their seed beds.

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**Milk Records.** It will be noticed that several new names appear amongst the owners sending in milk records, and it is hoped that this number will be considerably augmented before our next issue. The importance of milk recording cannot be over-estimated, and the advantages to be derived therefrom cannot be stated too often. It is therefore not out of place to recapitulate briefly some of the more outstanding advantages as detailed in Bulletin No. 402, "Milk Records and Milk Testing."

1. By keeping milk records we can find out those cows that do not pay for their feed.
2. By keeping milk records we find that those cows considered the highest producers are often the lowest, as cows differ enormously in their persistency of milk flow.
3. Milk records emphasise the benefit of liberality in the feeding of succulent and digestible foodstuffs, and prove that it pays handsomely to milk regularly and to protect the cows from rain and cold; particularly they teach the necessity for efficient milking.
4. Milk records increase the interest and pleasure of farming, and give the farmer an impetus to excel.
5. Natives take a great interest in milk records, and consequently the cows under their charge get better treatment.
6. Financially the keeping of milk records is of great benefit: in fact, it is becoming increasingly difficult to sell dairy bulls unless the milk record of their dams is produced.

In connection with milk recording, attention is directed to the article "The Hand-Rearing of Calves" published in this issue. Unless the cow is milked without the calf, milk recording must, of course, remain unsatisfactory, as the amount of milk absorbed by the calf is in most cases an unknown quantity.

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**Rhodesian Maize at Johannesburg.**—Although Rhodesia did not win the grand championship in the big classes at the Rand Spring Show this year, the reputation of Rhodesian white maize was fully maintained by the exhibits sent down, and Messrs. Bean and Kneiser are to be congratulated upon the notable successes obtained. The exhibits sent to the Rand show this year were less in number than in previous years owing to the fact that several of our leading maize growers generously donated their exhibits at the Salisbury show to the Empire Exhibition committee.

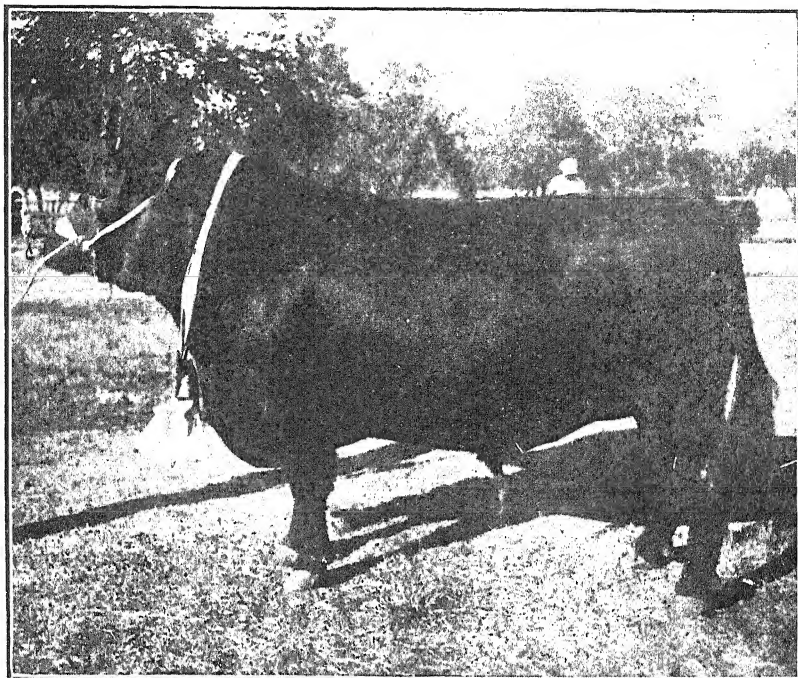
**Tobacco.**—The imports of unmanufactured tobacco into the United Kingdom during the year 1922 amounted to 184,515,488 lbs., of which total 12,653,513 lbs. were grown in British Possessions. To the latter total Nyasaland contributed 6,734,863 lbs., Canada 855,397 lbs. and Northern Rhodesia 360,325 lbs. During the first five months of 1923, 67,961,944 lbs. of unmanufactured tobacco were imported into the United Kingdom from the United States of America.

At a meeting of members of the Rhodesia Tobacco Co-operative Society, held in Salisbury on 20th September, it was decided to convert the society into a limited liability company, and the following directors were appointed:—Messrs. M. E. Cleveland, A. K. Dixon, A. C. Henderson, D. S. McLachlan and F. Smith.

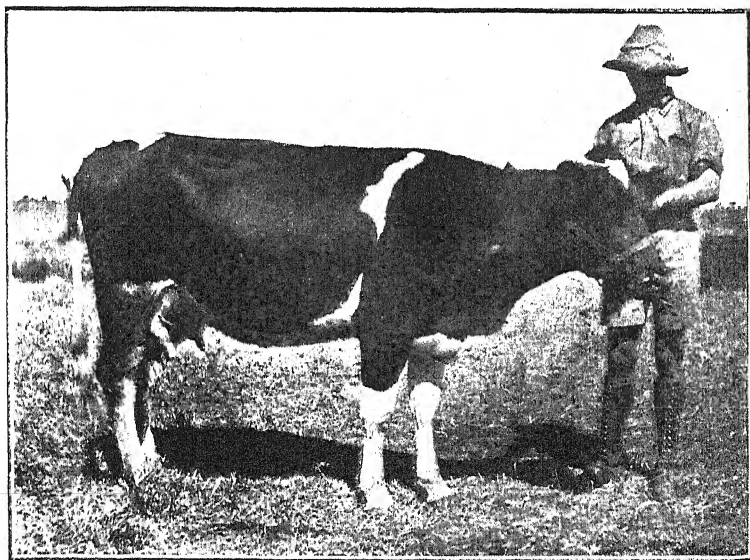
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**The Victoria Show.**—The seventh annual show of the Fort Victoria Agricultural and Horticultural Society, held in July, was of great educative value to the farmers of the district. The Victoria area is as yet sparsely populated, and attention is mainly directed to the rearing of cattle. As the country becomes more closely settled, however, the district will doubtless receive greater attention and arable farming become more general. That the Victoria district can grow produce of high quality was abundantly demonstrated by the recent show, and it is pleasing to record that the progress manifested on the occasion of the previous show is being maintained. The exhibits of Salisbury White shelled maize in particular were exceptionally good, while the seed maize was well selected and conformed to requirements. All other classes of produce were numerically well represented, and the quality in most cases left little to be desired. The outstanding feature of the show was the cattle, of which some fine specimens were on view. A deep impression on onlookers was created by a group of 28 Hereford cattle, all of considerable merit and all, with the exception of three, having been bred in the Victoria district. This speaks volumes for the enterprise of the Hereford men and for the prospects of this breed in the Victoria and neighbouring districts. Other breeds represented were Shorthorn, Red Lincoln, Devon, Africander, Friesland. The Victoria district can undoubtedly breed good cattle; and although the present outlook is clouded, we think that the confidence in the future evidenced by the acquisition of these well-bred animals will be duly rewarded.

The entries of poultry were very disappointing, only fifteen birds facing the judge. Of these, five were good, viz., three White Wyandottes exhibited by Mrs. Holland (two of these were exceptionally good) and two ducks exhibited by Mrs. Carey. The others were poor, and the majority also in poor condition. Considering the amount of literature that has been written in the Press and in this *Journal*, and the large amount of advice given by letter and otherwise, it is difficult to understand the lack of entries and quality of the birds.



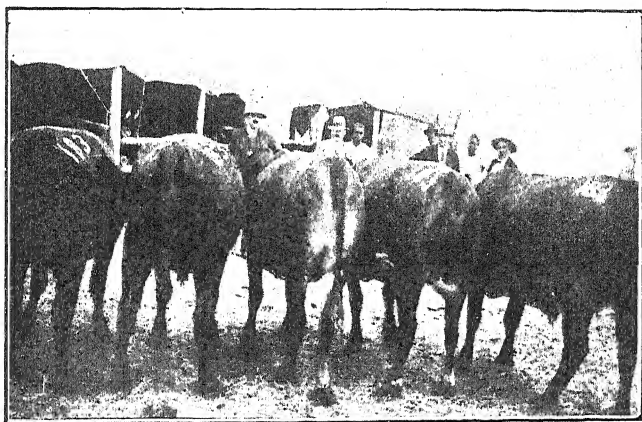
Black Band II. of Castlecraig, winner of Thousand Guineas Trophy,  
Bulawayo, 1923, and Milne Trophy, Salisbury, 1923.  
Owner, Mr. J. R. Stewart, Shangani.



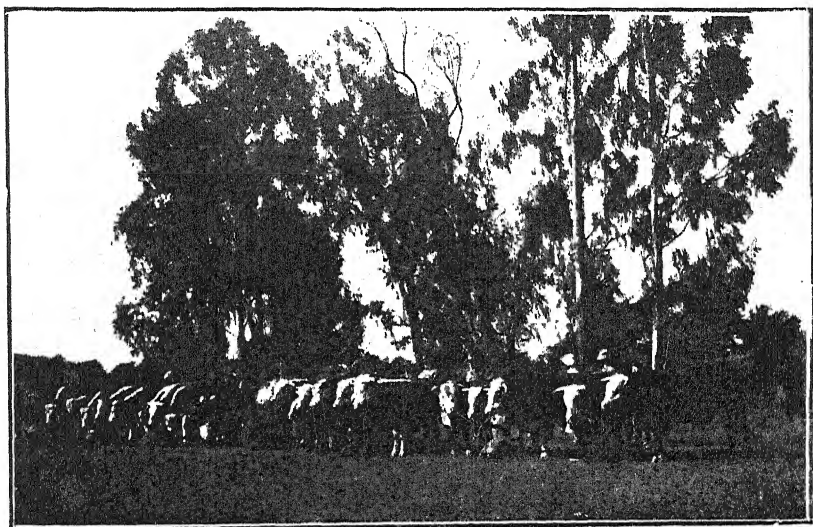
Brakfontein Klaske II., winner of milking competition, Salisbury Show,  
1923. Property of Messrs. Knight & Folkestad, Lochinvar.







First cross Aberdeen Angus bullocks, bred by Mr. D. Black, Selby, near Salisbury. Winners of class for slaughter oxen, any age, Salisbury Show. Sold for £16 each.



Parade of pedigree Hereford cattle, Victoria Show.



**The Salisbury Show.**—The Salisbury Show, held on the 14th, 15th and 16th August, fully maintained the high standard of excellence now looked for, and reflected the distinct progress which is being made in the agricultural and pastoral industries of the country. This Territory receives a great advertisement from the Salisbury Show, and we trust that the Agricultural and Horticultural Society will continue the progressive policy which has achieved such splendid results.

The entries this year totalled 2,342, a very satisfactory figure considering the present condition of the farming population. The attendance at the show was, however, not up to expectation, and disappointing compared with last year.

Despite the depression which has overtaken the pastoral industry, cattle were a feature of the show, and some excellent specimens of all the well known breeds were on view. The fine Aberdeen Angus bull Black Band II. of Castlecraig repeated his triumph of Bulawayo by winning the Milne Trophy for the best bull on the show. The numbers and quality of Friesland cattle on the show indicated the progress which the dairying industry is making in this Territory. The South African Friesland Breeders' Association is responsible very largely for the increased popularity of the breed in Rhodesia, and we trust the association will continue its far-sighted policy of sending up excellent specimens for exhibition and sale. South Devons were also in strong force, their numbers being augmented by cattle sent up by the South Devon Breeders' Association. The breed is becoming popular in Southern Rhodesia. The slaughter classes were exceptionally strong this year, a proof of the steady advance of the practice of stall feeding on the part of farmers in the principal grain districts.

The special prize of £25 for the best pen of five slaughter animals was won by Mr. D. Black's first cross Aberdeen Angus bullocks. These oxen were a wonderfully level lot, in prime condition, and later fetched £16 each.

The exhibits of maize were not so numerous this year as they were in the record year of 1920, when 30,000 cobs were staged. In that year the quality of the grain also was superior. The excessive rainfall of last season was responsible for the numerous damaged tips seen at this year's show, but the grain as a rule was weighty and well filled out. Of the standard varieties, Salisbury White gained the most points, carrying off the grand championship; it was followed by the newly introduced variety Potchefstroom Pearl. Hickory King claimed first place as regards numbers of entries, but the exhibits lacked the uniformity which has been so conspicuous a feature of this variety at previous shows.

In the produce section, oat forage, manna and teff hay showed a great improvement. There was a great falling off in beans, potatoes and wheat as regards quality. The latter exhibits were, of course, grown last year, when the drought adversely affected the crop. The exhibits of sunflowers and ground nuts, in which classes there is usually keen competition, were surprisingly few, but the quality was good.

The tobacco exhibited was of very fine quality and fully maintained the high standard of excellence set in previous years.

The exhibits of butter, with the exception of the creamery classes, were numerous, and the quality on the whole very good. Considering that the Salisbury Show is held at the worst time of the year from a dairying point of view, the entries were most gratifying. Most of the exhibits were penalised for lack of flavour, largely due to the cows not having been fed an adequate ration of succulents. Without this ration it is impossible for flavour to be developed in butter. In the cheese classes there was greater competition than ever before. The exhibits gave a good indication of the progress which has been made during the past season in this important branch of dairying. Considering that most of the cheese-makers were novices, the standard of quality was highly commendable.

Although bacon pigs were particularly numerous and good, yet competition in the bacon and ham classes was poor, owing to the fact that farmers wisely prefer to send their pigs to the factories than to undertake curing at home. The entries in the pig classes were numerically strong, and the judges had some difficulty in selecting the winners, especially in the slaughter classes.

One of the most interesting events of the show was the milking competition. Unfortunately at the last moment three cows were withdrawn. The winner was Brakfontein Klaske II., the property of Messrs. Knight & Folkestad, of Lochinvar, near Salisbury, and the runner-up Mr. J. A. Baxter's Ruby. The prize winner gave  $4\frac{1}{2}$  gallons of milk per day for the two days of the competition, testing on the average 3.2 per cent. butter fat. The runner-up produced 3 gallons of milk per day, averaging almost 4.5 per cent. butter fat.

The entries of sheep were more numerous than ever before, and some animals of excellent quality were on view. It is evident that sheep breeding is now regarded as a feasible proposition in parts of Southern Rhodesia, and we look for good results from the recent importations of good stock into the Territory.

The poultry, although not quite so numerous as last year, again showed an improvement in quality and also in variety of breeds. The heavy breed birds were very well represented indeed, and those most in evidence were the White Wyandottes, which were in strong force, the Rhode Island Reds, Barred Rocks and Black and Buff Orpingtons. Light Sussex too were well to the fore. White, Black and Brown Leghorns were good in quality. Many birds were in excellent condition, but others left much to be desired in this respect. Ducks of all breeds were excellent and the best yet seen on this show. Geese too were good. Turkeys, although not so numerous as last year, were good in quality. Some very fine dozens of eggs were to be seen, and it is gratifying to note that exhibitors have at last realised the necessity for grading and uniformity in the egg classes. There were a few appliances on view. It should be noted that in placing the awards, simplicity in making and working and cheapness are taken into consideration. The entries in foods were excellent, and it was very satisfac-

tory to see that the majority of these were from farmers and poultry keepers and grown and prepared by them. There were mixed grains, mixtures of grains, meals and leaf meals all produced in Rhodesia. The last mentioned included sunflower, lucerne, kikuyu grass, mealie, kudzu vine, beggar weed, etc., leaf meals. A special exhibit of excellent merit of leaf meal was shown by Mr. Tatham, of Penhalonga. We hope to see many more farmers and poultry keepers following this good example and selling these commodities direct to the poultry keeper.

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**The Bulawayo Show.**—The Bulawayo Agricultural Society has every reason to be gratified with the results of this year's show. The cattle industry is passing through very difficult times, and the prevailing depression naturally rendered the task of organising such a show as that of Bulawayo a very formidable undertaking. That all obstacles were so successfully overcome is a matter for congratulation, for this show occupies a very important place in our agricultural life and is productive of very much good. The presence of Their Royal Highnesses Prince and Princess Arthur of Connaught was gratifying to the people of Bulawayo and contributed to the record success achieved. As was the case last year in the principal sections, no prize money was awarded, but it is to be hoped that next year the financial position will permit of cash awards, for it must be conceded that exhibitors are entitled to some re-imbursement for the expense they incur. Cattle were as usual the feature of the show, and all breeds numerically, with the exception of Shorthorns, were well represented. Herefords constituted the strongest section, the entries being augmented by a number of fine animals sent up from the Union by Sir Abe Bailey and which were subsequently offered for sale. The thousand guinea trophy was awarded to Black Band II. of Castlecraig, the splendid Aberdeen Angus bull, the property of Mr. J. R. Stewart, of Shangani. Frieslands demonstrated by numbers and quality the growing popularity of the breed in Rhodesia and the greater interest being evinced in dairying. The slaughter classes were numerically a strong feature of the cattle exhibits, but the majority of steers were hardly as well finished as they ought to have been. The pen of five Lincoln Red Shorthorn steers bred and fed by Mr. J. Brebner, of Chabalala, elicited much praise and demonstrated how this great breed when rightly treated can also produce prime beef at an early age. It is also noteworthy that this breeder obtained top price for bulls at the stud sale the next day for a very fine specimen sold to Mr. H. M. Huntley. The challenge cup (value £25), presented by the Shorthorn Society of South Africa for the best animal in the Shorthorn and Lincoln Red Shorthorn classes, was awarded to Mr. Brebner's Baumber Nancy 10th.

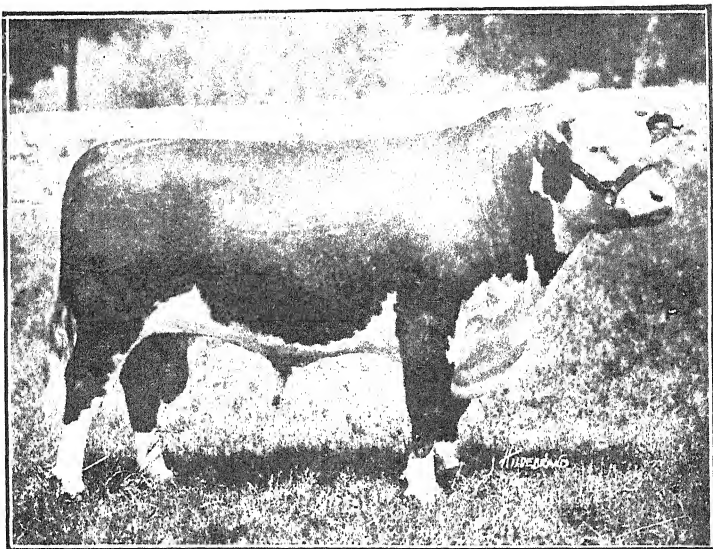
The maize exhibits were more numerous than usual, due to the more suitable date of the show. The quality on the whole showed a decided improvement over the exhibits of previous years, but it was obvious that exhibitors were hardly conversant with the requirements called for in show exhibits of grain. Judging by the appearance of

many exhibits, the owners could have submitted considerably better show material had they been versed in the art of selecting. An article on this subject appeared in the *Rhodesia Agricultural Journal*, June, 1922. The exhibits of shelled maize in the bag were numerous and generally of good quality. Competition was particularly keen in the classes for ground nuts, velvet beans and sunflower seed, a healthy sign that these crops are being grown more extensively in Matabeleland. There was a large number of entries in the classes for veld hay, but here the judges experienced difficulty in awarding prizes, owing to the fact that in this class were included bales of hay from natural veld and bales of hay from old lands. The committee would be well advised next year to make separate classes (1) for natural veld hay, (2) for old lands hay, and (3) for cultivated hay crops. A great variety of exhibits of farm crops was staged by the Municipal sanitary farm and the Ingutsheni Mental Hospital. The general exhibit of farm crops from the Municipal farm was the equal in quality and variety of any similar exhibit previously staged in Rhodesia, and cannot fail to have been a source of satisfaction to those responsible for the inception of this experimental station.

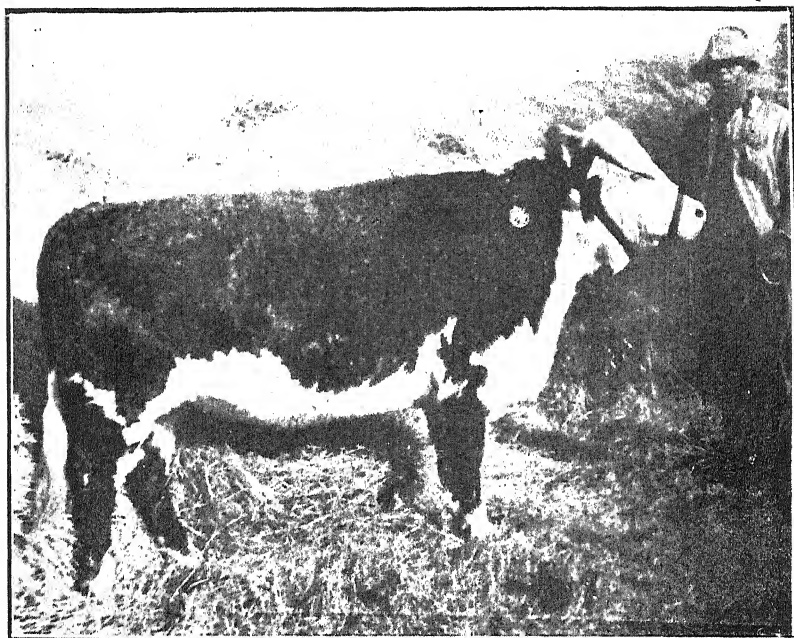
An exceedingly interesting exhibit was the woolled Persian and black-faced Persian sheep, ewes and rams brought from the Union by Mr. S. Montague Gadd, of Tafelburg. These sheep were subsequently sold at satisfactory prices.

There was the best display of commercial cheese ever seen at Bulawayo. This was due mainly to the increased quantity required for competition in the various classes. A very well staged exhibit of cheese sent up by three farmers in the Tati district attracted much attention, but it was interesting to note that all the prizes were gained by Rhodesian competitors, most of whom were novices. There was a larger display of creamery butter than that shown by individuals. This is as it should be, for if the industry is to expand, greater support must be accorded the creameries. The industrial hall was filled with exhibits of great interest. The Rhodesian Farmers' Co-op. Industries, Ltd., had some very fine exhibits of soap, oils and bacon, while Bulawayo merchants staged a wide variety of cattle feeds. Not the least interesting exhibit was the locally made furniture of Rhodesian teak. The Department of Agriculture was housed in the Hull Memorial Hall, the whole of this fine building being set apart for its use, thus enabling the Departmental exhibits to be staged to the best possible advantage.

The poultry section was as usual the centre of much attraction and interest. The birds were well staged in the spacious and well ventilated poultry hall. The show was well organised and everything passed off without a hitch. The entries, although not quite so numerous as last year, were large, and the quality throughout was good. A number of birds from the Union were competing, and although a number were awarded prizes, the Rhodesian birds more than held their own. The Barred Rocks, the Rhode Island Reds, the White Wyandottes and White Leghorns were most numerous, and the quality was excellent. Light Sussex were well to the fore, and Buff and



Woodford 120th, bred in Kentucky, U.S.A., and imported by  
Mr. C. S. Jobling, Bulawayo.



Rhodesian bred cow. Dovenby Drusilla, at three years old; winner open  
female championship (all breeds) at the Bulawayo Show three years  
in succession—1921, 1922 and 1923. Bred by  
Mr. C. S. Jobling, Bulawayo.





Black Orpingtons showed up well. One of the features of the show was the breeding pens of heavy breeds; these were all excellent and were shown not in exhibition pens, but in ordinary poultry houses and runs erected by Messrs. Hogarth & Co. outside, adjacent to the poultry hall, an innovation carried out for the first time in South Africa. Another feature of the show was the egg exhibit. A large special exhibit was staged by the Bulawayo depot of the egg circle, and there were numerous single dozens of eggs from poultry keepers, boxes of 30 dozen in each, etc., all for competition. There were in all about 5,000 eggs, and all of these were of excellent quality. The special prizes numbered 159.

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## Cotton Culture.

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By H. W. TAYLOR, B.Agr., Tobacco and Cotton Expert.

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The high price of raw cotton, brought about by shortage of supplies, particularly of the American Upland type, has caused interest to be taken in the production of this important crop by farmers and commercial men in many parts of the world.

Statisticians point out that the carry over of cotton from year to year is rapidly decreasing. The figures given are as follows:—

### WORLD STOCKS OF COTTON. (1)

| Date.                   | American.  | All kinds. |
|-------------------------|------------|------------|
| 1st August, 1921 ... .. | 9,351,000  | 14,752,000 |
| 1st August, 1922 ... .. | 5,123,000  | 9,536,000  |
| 1st August, 1923 ... .. | 2,775,000* | 6,651,000* |

\* Estimated.

The reduction in the carry over of cotton is due to decreased production rather than an increase in consumption, as is shown by the following table:—

# WORLD'S COTTON PRODUCTION AND CONSUMPTION FOR YEARS INDICATED. (1)

(In bales of 478 pounds lint.)

| Years.                                 | In thousands of bales. |                         |                          |
|----------------------------------------|------------------------|-------------------------|--------------------------|
|                                        | World's<br>production. | World's<br>consumption. | European<br>consumption. |
| 1908-09 ... ..                         | 20,604                 | 20,289                  | 10,968                   |
| 1909-10 ... ..                         | 16,988                 | 19,164                  | 10,295                   |
| 1910-11 ... ..                         | 18,856                 | 19,888                  | 11,040                   |
| 1911-12 ... ..                         | 22,247                 | 21,534                  | 11,998                   |
| 1912-13 ... ..                         | 21,550                 | 22,533                  | 12,117                   |
| 1913-14 ... ..                         | 22,612                 | 22,199                  | 12,029                   |
| 1914-15 ... ..                         | 24,861                 | 20,670                  | 10,606                   |
| 1915-16 ... ..                         | 18,461                 | 21,978                  | 10,878                   |
| 1916-17 ... ..                         | 18,924                 | 21,108                  | 9,044                    |
| 1917-18 ... ..                         | 18,141                 | 18,515                  | 6,621                    |
| 1918-19 ... ..                         | 18,765                 | 16,705                  | 5,962                    |
| 1919-20 ... ..                         | 20,219                 | 19,300                  | 7,699                    |
| 1920-21 ... ..                         | 19,675                 | 16,914                  | 6,736                    |
| 1921-22 ... ..                         | 14,741                 | 20,047                  | 7,771                    |
| 1922-23 ... ..                         | 17,664                 | 20,579                  | 7,623                    |
| Average, 1908-09 to<br>1914-15 ... ..  | 21,102                 | ...                     | ...                      |
| Average, 1908-09 to<br>1916-17 ... ..  | ...                    | 21,040                  | 10,996                   |
| Average, 1915-16 to<br>1920-21 ... ..  | 19,031                 | ...                     | ...                      |
| Average, 1917-18 to<br>1920-21 ... ..  | ...                    | 17,860                  | 6,755                    |
| Average, 1921-22 and<br>1922-23 ... .. | 16,202                 | 20,313                  | 7,697                    |

From the above tables it will be noted that the carry over of American cotton on 1st August was only 2,750,000 bales, and only 6,500,000 bales of all kinds, including American. In other words, the stocks of American cotton have diminished by 6,500,000 bales, and the stocks of all kinds by more than 8,000,000 bales within two years, and have reached an abnormally low total.

The tables also show that although the European consumption of cotton is only 70 per cent. of the pre-war average, the world consumption is almost back to normal. The figures given above show that from 1918-19 to 1922-23 inclusive the total production of cotton was 91,064,000 bales, whilst the total consumption for the same period was 93,545,000 bales. In other words, consumption exceeded production by 2,481,000 bales, which was met from the carry over from previous years.

The decrease in world production has been due chiefly to the reduced output from the American cotton fields, as is shown by the following figures:—

COTTON PRODUCTION IN U.S.A. FOR YEARS INDICATED.  
(Thousands of bales, as finally reported by U.S. Bureau of the Census.)

| Country.      | Years. |        |        |        |        |        |        |        |       |       |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|-------|-------|
|               | 1913   | 1914   | 1915   | 1916   | 1917   | 1918   | 1919   | 1920   | 1921  | 1922  |
| United States | 14,156 | 16,135 | 11,192 | 11,450 | 11,302 | 12,041 | 11,421 | 13,440 | 7,954 | 9,964 |

These figures show that the average annual production of cotton in America for the five-year period 1913-17 was 12,867,000 bales, and for the five-year period 1918-22 was 10,760,000 bales, or an average decrease in the latter period of 2,107,000 bales per year. That the production of cotton in the southern States of America is decreasing there can be little doubt, but whether the production will again increase to pre-war level is purely a matter of conjecture. The decrease has been due primarily to two causes, viz., shortage of labour and the ravages of the boll weevil. Cotton is grown in the southern States principally by coloured or negro labourers, who have been attracted in large numbers from the land to industrial centres, where increased wages are to be earned with shorter hours of labour. With decreased labour the acreage must be reduced or cultural operations somewhat neglected, either or both of which usually result in lowered production. The percentage of decrease due to reduction of labour cannot be ascertained, but the decrease due to boll weevil has been tabulated and is given below:—

PERCENTAGE OF LOSS OF COTTON DUE TO BOLL WEEVIL, 1909-21. (2)  
(Expressed in percentage of a normal or full yield per acre.)

|                              | 1909            | 1910            | 1911            | 1912            | 1913            | 1914            | 1915            | 1916            | 1917            | 1918            | 1919            | 1920            | 1921            |
|------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| North Carolina               | per cent. ...   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. 3.58  |
| South Carolina               | per cent. ...   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. 0.02  | per cent. 0.02  | per cent. 0.01  | per cent. 9.07  | per cent. 3.00  | per cent. 13.26 | per cent. 31.48 |
| Georgia...                   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. 0.10  | per cent. ...   | per cent. 0.28  | per cent. 3.44  | per cent. 9.06  | per cent. 10.73 | per cent. 19.36 | per cent. 30.56 | per cent. 45.12 |
| Florida                      | per cent. ...   | per cent. ...   | per cent. ...   | per cent. 0.30  | per cent. 11.80 | per cent. ...   | per cent. 13.14 | per cent. 20.98 | per cent. 27.07 | per cent. 23.85 | per cent. 40.46 | per cent. 32.10 | per cent. 27.62 |
| Tennessee                    | per cent. ...   | per cent. ...   | per cent. ...   | per cent. ...   | per cent. 0.10  | per cent. 0.08  | per cent. 0.04  | per cent. 1.23  | per cent. 1.74  | per cent. 0.37  | per cent. 0.17  | per cent. 0.57  | per cent. 7.21  |
| Alabama                      | per cent. 0.10  | per cent. 0.05  | per cent. 0.20  | per cent. 1.50  | per cent. 4.80  | per cent. 6.02  | per cent. 16.16 | per cent. 27.91 | per cent. 28.88 | per cent. 12.14 | per cent. 28.77 | per cent. 36.03 | per cent. 32.39 |
| Mississippi                  | per cent. 4.20  | per cent. 14.66 | per cent. 5.10  | per cent. 18.00 | per cent. 33.90 | per cent. 24.14 | per cent. 24.08 | per cent. 31.73 | per cent. 22.22 | per cent. 10.41 | per cent. 19.56 | per cent. 32.25 | per cent. 30.38 |
| Louisiana                    | per cent. 41.70 | per cent. 40.80 | per cent. 11.40 | per cent. 13.70 | per cent. 25.10 | per cent. 17.66 | per cent. 19.85 | per cent. 24.31 | per cent. 11.89 | per cent. 9.79  | per cent. 24.84 | per cent. 25.99 | per cent. 34.80 |
| Texas ...                    | per cent. 12.10 | per cent. 6.52  | per cent. 0.90  | per cent. 2.80  | per cent. 6.80  | per cent. 7.86  | per cent. 16.28 | per cent. 18.53 | per cent. 7.26  | per cent. 4.43  | per cent. 13.96 | per cent. 19.90 | per cent. 33.60 |
| Oklahoma                     | per cent. 3.00  | per cent. 1.27  | per cent. 0.20  | per cent. 0.50  | per cent. 0.40  | per cent. 0.79  | per cent. 2.70  | per cent. 3.70  | per cent. 4.35  | per cent. 1.30  | per cent. 1.48  | per cent. 8.81  | per cent. 41.36 |
| Arkansas                     | per cent. 6.10  | per cent. 7.23  | per cent. 2.00  | per cent. 2.40  | per cent. 2.80  | per cent. 2.93  | per cent. 4.60  | per cent. 7.49  | per cent. 8.96  | per cent. 3.14  | per cent. 4.79  | per cent. 9.41  | per cent. 21.84 |
| Average for United States... | 6.13            | 5.30            | 1.28            | 3.26            | 6.69            | 5.91            | 9.93            | 13.36           | 9.34            | 5.83            | 13.20           | 19.95           | 30.98           |

Statistics from Year Book of the U.S. Department of Agriculture, 1922.

These figures indicate that the loss due to boll weevil is sufficient to account for the decrease in the production of American cotton, and also indicate that, unless this pest can be either controlled or eradicated, the problem of increased production in the southern States will be difficult.

This decrease in production has naturally led to diminished supplies for export from the United States, but the amount of raw cotton available for export from America has been seriously reduced from an altogether different cause. For many years the bulk of American grown cotton was exported for manufacture in Continental and English mills. In recent years there has been a tremendous increase in cotton manufacturing in the United States. In 1911-12 the cotton mills of the United States used only 33 per cent. of the cotton produced in that country. By 1914-15 the amount had increased to 40 per cent., and in 1917-18 the amount used by American mills had risen to 58 per cent. of the amount produced in that country. During 1921-22 the United States' mills used 5,904,000 bales out of a total production of 7,954,000 bales, or 74 per cent. Not only then is the production of cotton in the United States decreasing, but the percentage used by the mills of that country is rapidly increasing, so that the proportion remaining for export to other countries is diminishing from two causes.

This condition of the cotton trade has caused English manufacturers to express doubt as to continued supplies from American cotton fields, and to express the fear that if supplies should be forthcoming the price would be prohibitive unless cotton fields in other parts of the world are developed. In Great Britain the huge sum of £500,000,000 is invested in the cotton industry, and it is estimated that 10,000,000 of the inhabitants are either directly or indirectly dependent upon this trade for their livelihood. Any economic condition which adversely affects the cotton industry in Great Britain is a national calamity. The average annual consumption of raw cotton in Great Britain is approximately 3,000,000 bales, four-fifths of which come from the cotton fields of the United States. British manufacturers are therefore naturally desirous of stimulating the production of cotton within the Empire, in order that they may not be entirely dependent upon the United States for their supply of Upland cotton.

**Parts of the Empire Capable of Growing Cotton.**—Cotton has of course been grown in India for centuries, but the quality of the great bulk of the product is not such as is required for manufacture by English mills. The West Indies produce cotton of very fine quality, but the industry is not capable of great expansion. After many attempts, cotton has during recent years been established as a crop of economic importance in Australia. Cotton growing has made remarkable strides in parts of the Commonwealth during the past few years, and as regards soil and climatic conditions is no doubt capable of considerable expansion. The problem of cheap labour for harvesting would appear, however, to be the chief obstacle to rapid and permanent expansion of the cotton growing industry in Australia. Egypt has long been noted for the fine quality of its cotton, and at present produces more cotton of desirable grades than all the possessions of the

British Empire. Cotton growing in the Sudan is capable of great expansion, but requires the expenditure of considerable capital for irrigation and development. Uganda now ranks as a cotton producing country of importance. The quality is good, soil and climatic conditions are suitable, and with an abundance of labour there is every reason to believe that cotton growing is capable of considerable expansion in that Protectorate, but development of the industry is largely dependent upon adequate transport facilities. Tanganyika territory also possesses, in certain areas, soil and climatic conditions suitable for cotton growing, and with its abundant labour supply should develop into a cotton producing country. Cotton has long been grown by the natives of Nigeria, and the crop has now been developed on commercial lines and is a source of large total revenue to the native farmers. Of Nigeria it has been said that "it is the most promising area in the British Empire (except India) for producing large quantities of cotton comparable with ordinary American, the type of cotton upon which Lancashire so largely depends." (3) Cotton is also grown in Nyasaland and the Union of South Africa, and can be grown in certain areas of Northern and Southern Rhodesia.

The determining factors in cotton production, in common with other farm crops, are soil and climate. Of the two, the latter is more important, as cotton can be produced on a wide variety of soils.

**Climate.**—The climatic conditions required for profitable cotton culture are as follows:—(1) A growing period of six months or more without frost; (2) a moderate, well-distributed rainfall during the growing period; (3) plenty of sunshine and little or no rainfall during the maturing period. The cotton plant requires a rather long period for full development and is very susceptible to frost, and its culture must therefore be confined to those zones usually described as middle and low veld. In those areas where the growing season—from the first spring rains to the first killing frost—is less than six months, cotton cannot be successfully produced.

It is now generally recognised that a rainfall of from 20 to 25 inches is sufficient for cotton production if properly distributed. In the early stages only sufficient rainfall is required to maintain growth. An abundance of rain at this period prevents proper cultivation and induces a rank growth of weeds and grass between the plants, both of which are highly undesirable. Larger yields of cotton are obtained when the rainfall is slightly deficient rather than excessive. Dry weather, with an abundance of sunshine during the maturing and harvesting period, is especially favourable for cotton production. These conditions do not always prevail in America, where cotton is often damaged by rain before it can be picked, which causes the lint to be stained or "tinged" and materially lowers its value. In the sections of Rhodesia suitable for cotton cultivation the rains have usually ceased by harvesting time, so that practically no cotton is damaged by excessive moisture after the bolls open unless ratooning is practised.

**Soil.**—Cotton can be produced on practically any class of soil, provided it is of the required fertility and well drained, if climatic conditions are suitable. Cotton, in common with other crops, requires,

however, certain soil conditions for its successful and commercial production.

It has been found from practical experience that the classes of soil best suited to cotton cultivation are sandy and clay loams and alluvial soils. Cotton soils should be of medium fertility, well drained, and contain a fair amount of organic matter. Light sandy soils produce good cotton when properly manured or fertilised, but unless carefully handled, these soils produce unprofitable yields. Stiff, heavy clay soils are not generally recommended for cotton growing in Southern Rhodesia. When planted on this type of soil, cotton usually makes an excessively luxuriant growth, matures late and returns poor yields.

The state of soil fertility for cotton growing should be such that the land would produce 6 to 7 bags of maize per acre without the addition of manure or fertiliser. If below this state of fertility, manure or fertiliser should be applied; and if very much above this state of fertility (Fig. 1), maize is recommended as a more suitable crop to grow, provided other conditions are favourable for maize production. For successful cotton culture the soil should be well drained and should have been under cultivation to some other crop or fallowed during one rainy season. Cotton does not generally produce profitable returns when grown on freshly ploughed virgin soil.

**Preparation of the Soil.**—The cotton plant is very delicate when it first appears above the surface of the soil, and the land intended for the production of this crop should be well prepared in order that the young plants may have every advantage as regards soil moisture and plant food during the early stages of growth. The best time for ploughing is during the winter months. This allows the soil to weather for some time, which is beneficial, and also enables the farmer to plant earlier in the spring. After ploughing, the soil must be brought into fine tilth with disc and tooth harrows to provide a proper seed bed. If the soil breaks up into clods during the winter, these will be moistened by the early rains, when the land can receive its final preparation and be planted at once. Other things being equal, the earlier the crop is planted in the spring, the better chance the plants have of reaching full maturity and producing the maximum yield.

The depth of ploughing should be regulated by the depth of the surface soil. In ploughing care should be taken that the sub-soil is not brought to the surface. It is better to plough slightly too shallow rather than too deep.

**Effect of Cotton on the Soil.**—Cotton is the least exhaustive of soil fertility of the staple crops grown in South Africa.

## PLANT FOODS REMOVED FROM THE SOIL BY CROPS.

| Crop.                    | Nitrogen. | Phosphates. | Potash. | Total. |
|--------------------------|-----------|-------------|---------|--------|
|                          | lb.       | lb.         | lb.     | lb.    |
| <i>Cotton</i> :—         |           |             |         |        |
| 300 lb. Lint ...         | 1.02      | 0.30        | 1.37    |        |
| 650 lb. Seed ...         | 20.34     | 10.67       | 7.84    |        |
|                          | 21.36     | 10.97       | 9.21    | 41.54  |
| <i>Maize</i> :—          |           |             |         |        |
| 8 $\frac{3}{4}$ bags ... | 32.14     | 12.36       | 7.06    |        |
| 4,000 lb. Stover ...     | 41.60     | 11.60       | 56.00   |        |
|                          | 73.74     | 23.96       | 63.06   | 160.76 |
| <i>Wheat</i> :—          |           |             |         |        |
| 3 $\frac{1}{2}$ bags ... | 19.75     | 7.44        | 5.10    |        |
| 2,300 lb. Straw ...      | 13.57     | 2.76        | 11.73   |        |
|                          | 33.32     | 10.20       | 16.82   | 60.35  |
| <i>Tobacco</i> :—        |           |             |         |        |
| 1,000 lb. Leaf ...       | 44.00     | 5.00        | 52.00   |        |
| 353 lb. Stalks ...       | 12.00     | 2.00        | 17.00   |        |
|                          | 56.00     | 7.00        | 69.00   | 132.00 |

From the above table it will be noted that a crop of 8 $\frac{3}{4}$  bags of maize per acre requires approximately four times as much nitrogen, phosphorus and potash combined as a crop of 300 lbs. of cotton lint. A crop of 3 $\frac{1}{2}$  bags of wheat removes one-third more of these elements of plant food and a crop of 1,000 lbs. of tobacco more than three times as much plant food as a crop of 300 lbs. of cotton. Burkett (4) gives an even more striking comparison by using the average yield per acre of cotton lint and the grain of maize and wheat as produced in the United States. His figures are as follows:—

| Crop.                   | Nitrogen. | Phosphates. | Potash. | Total. |
|-------------------------|-----------|-------------|---------|--------|
|                         | lb.       | lb.         | lb.     | lb.    |
| 190 lb. Cotton Lint ... | 0.65      | 0.19        | 0.87    | 1.71   |
| 29.4 bus. Maize ...     | 32.14     | 12.36       | 7.06    | 51.56  |
| 13.95 bus. Wheat ...    | 19.75     | 7.44        | 5.10    | 32.29  |



From the above figures it will be seen that an average crop of wheat grain removes nineteen times as much plant food from an acre as an average crop of cotton lint, and that an average crop of maize grain removes thirty times as much plant food from an acre as an average crop of cotton.

If the seed as well as the stems and leaves of the plant were returned to the soil, a crop of 300 lbs. of cotton lint would only remove a total of 2.69 lbs. of the elements of fertility from an acre. In practice, however, this is seldom done, as the seed is disposed of to oil mills, so that some method of soil management must be adopted which will ensure good yields for an indefinite period of time.

**Seed Selection.**—One of the most important operations in cotton cultivation, as well as in the production of other field crops, is the selection of good seed for planting. By good seed is meant seed which has a high germination, which will produce plants true to type, and plants which show high productiveness and as early maturing as possible consistent with varietal characteristics. The lint also should be of good length, strength and fineness. The cotton plant is very susceptible to changes of soil and climate, and for this reason the seed for planting should be selected with the greatest care. This is especially true in districts where cotton cultivation is just being started. When cotton is grown for the first time in a locality it often proves disappointing as to yield and quality of lint. If the field is gone over carefully, however, a large number of plants will be found which are true to type and which carry a large number of well-developed bolls containing cotton of excellent quality. Cook (5) points out that "the best plants, rather than the worst or general average, represent the proper test of the possibilities of varieties under new conditions."

In fields of cotton, plants are often found which are sterile or partially sterile, while others show a tendency to be dissimilar to the varietal type. The seed from plants showing either of these characteristics should not be used for planting, since the resulting crop would, in all probability, show a large number of sterile plants or plants of diverse character, which are important factors in decreasing both the yield and the quality of the lint. Seed should be used only from those plants showing uniformity to type and producing a large number of well-developed bolls. The lint from these plants should be uniform, of good colour, length and strength.

Dr. H. J. Webber (6) gives the details of a system by which cotton can be selected to a very high state of productiveness and quality. The diagram prepared by Dr. Webber to illustrate the system is given below:—

|              | 1st Year.    | 2nd Year.     | 3rd Year.     | 4th Year.       | 5th Year.     |
|--------------|--------------|---------------|---------------|-----------------|---------------|
| Select Plant | (1)          | 500<br>Plants | 5 acres       | General<br>Crop |               |
|              |              |               |               |                 |               |
| Select Plant | (1)          | 500<br>Plants | 5 acres       | General<br>Crop |               |
|              |              |               |               |                 |               |
|              | Select Plant | (1)           | 500<br>Plants | 5 acres         |               |
|              |              |               |               |                 |               |
|              |              | Select Plant  | (1)           | 500<br>Plants   |               |
|              |              |               |               |                 |               |
|              |              |               | Select Plant  | (1)             | 500<br>Plants |
|              |              |               |               |                 |               |
|              |              |               |               | Select Plant    | (1)           |

In the beginning a single plant, or, better, two or more plants which conform to the breeder's ideal are selected. The seed from these plants is carefully saved and planted separately the following season, and the progeny from each selected plant should give 500 plants. From the progeny of the selected plant giving the best results one or more plants are selected for the following year, and the seed from the remainder of the plants is used for planting a five-acre plot. The five-acre plot will then produce sufficiently highly selected seed for the general crop the following season. In this way at the end of the third year the breeder has a single selected breeding plant, a plot of 500 selected breeding plants, and a five-acre breeding plot of selected plants for seeding the main crop the following year. If this system is maintained, the variety of cotton grown instead of deteriorating will continue to improve until a very high state of perfection is reached. This method of seed selection is specially suited to those growers who make a business of supplying seed to other growers for planting purposes. Growers who exercise the necessary care in selecting seed according to this system are able to demand a premium for their surplus stock, and when the public realises the importance of planting good seed they are more than ready to pay a higher price for the better article.

A shorter method of seed selection, and one which will more readily appeal to the ordinary farmer, is as follows: When the bolls begin to open, go through the cotton field and carefully select those plants which are true to type, productive and early in maturing. These plants should be clearly marked so that no mistake can be made. Then pick the cotton from these plants and store it separately. It should be carefully ginned on a gin which has been thoroughly cleaned to prevent mixing. The seed thus selected should be used for planting the following season. This method is lacking in many respects, but will give satisfactory results if carefully followed.

**Planting.**—The proper time for planting is after the first spring rains. If the rains are late, the seed can be planted in dry soil so that they may germinate from the moisture of the first rainfall. There is, however, one element of danger in planting in dry soil, as it sometimes happens that the first rain of the season is sufficient to produce germination, but does not provide sufficient soil moisture to maintain proper growth of the young, tender seedlings, which die before the next rains fall. Where the farmer has ploughed his lands during the winter he can plant from two weeks to one month earlier

than the grower who waits for rain before breaking his soil, and as a rule his yield will be proportionally larger. The first good rains usually occur in November, and planting should be done during this month. In sections where no frost occurs, planting can be continued somewhat later, but the rule should be to plant as early as possible.

The rows should be three to four feet apart, depending on the fertility of the soil. On soils above medium fertility the rows should be four feet apart, and on poor soils three feet apart would be a more suitable distance. If the soil is of medium fertility the rows are best placed at three-and-one-half feet apart, and this distance will generally apply in Southern Rhodesia. The cotton plant requires the maximum amount of sunshine for its best development, and when possible the rows should be aligned east and west, in order that the crop may receive full benefit of every hour of sunlight.

Seeding can either be done by hand or with a cotton planter. If only 20 acres or less are to be planted and labour is available, this work can be done by hand and the expense of a planter is saved. Hand planting is very simple. The field is aligned in any desired manner and three cotton seeds placed in the soil at each interval of eight to ten inches along the rows. Large acreages are of course best seeded with a proper cotton planter. There are several makes of cotton planters on the market, and all give good results. Both single and double row planters are obtainable, but the latter are more economical to operate and usually give more satisfactory results. Cotton planters have attachments for planting maize and give good results in planting this crop, but maize planters seldom have attachments for planting cotton.

Cotton is usually planted on level soil, but if the land is inclined to become water-logged, the crop is best grown on ridges. This applies particularly to sandy soils in sections where the rainfall is normally heavy.

When a planter is used, 20 to 25 pounds of cotton seed should be sown per acre, but if planted by hand the amount can be somewhat reduced. Cotton seed is inexpensive, and sufficient seed should be used to ensure a perfect stand. In soils which are inclined to form a hard crust after heavy rains, seeding should be especially heavy, otherwise the young seedlings will not be able to break through the crust, and the resulting stand will be poor. The greatest care must be exercised in seeding, whether by hand or by machine. Cotton seed should not be placed deeper than one inch in the soil, and the best results are obtained when the seed are just barely covered with soil.

Good yields depend to a large extent upon a good stand of plants. A good stand of plants can only be secured by using plenty of good seed, thorough preparation of the soil and proper planting. Every vacant space in the rows reduces the yield and thereby reduces the profit per acre.

**Thinning.**—When the young plants are from six to eight inches in height they should be thinned to stand eight to ten inches apart in the rows. Both experimental and practical results have shown that this spacing generally gives the best results.

The cotton plant produces two kinds of branches known as vegetative and fruiting branches. The former are developed from the lower nodes of the main stalk, and are usually known as wood limbs. They are similar to the main stalk, and do not directly bear flowers or bolls. The fruiting branches arise directly from the main stem, or from vegetative branches, and carry the flowers and bolls. If the vegetative branches develop abnormally large, as often happens when cotton plants are far apart, their foliage shuts out the sunlight from the fruiting branches and prevents the proper and rapid formation of bolls. It has been found that when the plants stand close together in the rows the growth of vegetative branches is reduced and the production of fruiting branches is induced. This causes the plants to mature earlier and also to give a larger yield per acre.

Thinning can be done either by hand when the soil is damp and soft, or with hoes. All grass and weeds between the young plants should be removed at the same time. In thinning care should be taken to remove the weak and injured seedlings, leaving only the strong vigorous plants.

**Cultivation.**—Cultivation should be commenced as soon as the young plants are up high enough for the rows to be followed. Shallow cultivation is advised, but should the soil become packed through heavy rains during the early growth of the plants, deep cultivation should be resorted to in order to loosen and aerate the soil. After the plants reach a height of about twelve inches, cultivation should not be deeper than two-and-one-half inches. It has been found that the lateral feeding roots of the cotton plant commence spreading through the soil about three inches below the surface, and continue to do so to a depth of about nine inches (4). If deep cultivation is practised after the roots spread through the soil the feeding roots will be injured and the vitality of the plants will be weakened.

The objects of cultivation are to kill weeds and grass which spring up in the field and to keep a finely pulverised mulch on the surface which prevents the evaporation of soil moisture. These objects can usually be accomplished by shallow cultivation. Cultivation should be continued until the plants are in flower and should then cease. Any weeds and grass which appear later should be removed by hand hoeing.

**Picking.**—When the crop becomes white with open bolls picking should begin (Fig. 2). In picking, only the seed cotton should be removed, and care taken to prevent dry leaves, portions of bolls or other foreign substances from being mixed with the seed cotton, as dirty or trashy cotton is of lower value. Two or three pickings are required to harvest the crop.

In most seasons rains have practically ceased before cotton is ready for picking, so that there is little danger of the lint being damaged by excessive moisture. In case the seed cotton is moist from dew or light showers of rain, it should be spread in the sun to dry before being stored.

Any receptacle can be used for picking, but convenience in this connection will facilitate the operation. A sugar pocket opened along



Cotton at flowering stage, showing excessive vegetative growth;  
planted on soil too rich for cotton.



Field of cotton at Mr. J. H. Farmer's farm Malvern, Bindura..



one side and closed at both ends makes a very handy receptacle. A reim or strong cord is fastened at either corner and then slung over the neck and one shoulder. The pocket can be divided into two parts, and the mouth of each can be held open with a wire hoop. In picking, clean white cotton should be kept separate from trashy and badly stained cotton, and natives can be trained to use one portion for clean and one for trashy and badly stained cotton, so that grading can, to a certain extent, be done during picking. Natives are rather slow in the beginning, but can easily be taught so that they will pick sufficient seed cotton to pay their hire. They should be instructed to grasp each lock or portion of the boll at the same time and to remove the cotton with a quick movement of the hand.

The seed cotton should be graded before storing preparatory to despatch to the ginnery. Clean white cotton should be packed separately from trashy and stained cotton. The clean white cotton of the first and second pickings should not be mixed with that of later pickings, as the latter will probably have shorter staple and a certain amount of immature fibre, and will consequently realise a lower price. Wool packs are the most convenient containers in which to store and despatch cotton to the ginnery. When properly filled, wool packs will hold from 400 to 500 lbs. of seed cotton. Seed cotton should not be baled for sending to the ginnery. The pressure causes the lint to become entangled, and the fibre may be damaged in ginning; also some of the seed may become crushed, and the oil will stain the lint.

**Preparation for Market.**—Before cotton can be marketed, the lint must be separated from the seed, and for this operation a machine known as a gin is required. After ginning, the lint is pressed into bales of 500 lbs. each, covered with hessian and bound with strap iron to prevent expansion. A complete ginning plant then consists of one or more gins, a press, buildings and suitable power. The whole plant will therefore require considerable capital outlay.

The lack of proper facilities for preparing cotton for market has in the past been the chief obstacle to cotton growing in Southern Rhodesia. This difficulty has now been overcome, and a complete plant will be erected in Salisbury to handle the crop to be produced this coming season.

A market for cotton now exists in South Africa, and buyers are prepared to purchase Rhodesian grown cotton f.o.r. Salisbury. This will enable farmers to obtain the money for their crop as soon as the cotton is ready for delivery.

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# Soil Treatment and Manuring for Maize Production.

(REPORT UPON EXPERIMENTS EXTENDING  
OVER FOUR YEARS.)

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The experiments in soil treatment with which this report deals were commenced at the Agricultural Experiment Station, Salisbury, in season 1919-20, and the report constitutes a record of the results which have been obtained during the past four seasons. The object of these experiments has been to compare not only the relative values of fertilisers, of green manure alone and of green manure in conjunction with fertilisers for maize production, but also to obtain data as to which of those three lines of manurial treatment was the most permanently effective in preserving or improving the fertility of the soil.

For the information of those who may not have studied the subject, it may be well before dealing with the results of these experiments to discuss very briefly the general principles of manuring, so that that which follows may be clearly understood. During growth, a plant takes up a large number of substances from the soil, the majority of which are fortunately present in quantities so large that the continuous growth of plants without the application of fertilisers would probably not reduce them to a point affecting the productive power of the soil. There are, however, three substances in which a soil is liable to become deficient, viz., nitrogen, phosphoric oxide and potash. Lime may also be included in the list, but that substance is generally present in sufficient quantity to meet the food requirements of plants.

The main object of using fertilisers is to supply one, two or all three of the substances mentioned above; and if a particular soil already contains an abundance of one of those constituents in forms which plants can make use of as a source of food, it would obviously be a waste of money to apply to such a soil a fertiliser containing that constituent. Thus, fertilisers are valuable solely for their contents of those elements of plant food which soils are liable to lack. There is, however, another aspect of soil management which is of the first importance in all countries, especially so in tropical and sub-tropical



climates if any distinction is made, and that is the supply of humus which results from the decay of organic matter. The importance of humus in soil fertility lies not only in the fact that it provides food for crops as well as for the soil organisms, which everywhere exert an important influence upon fertility, but also in the improvement which it effects in the physical condition and water-holding power of the surface soil.

The maintenance of an adequate supply of humus in arable land can be provided for by rotation of crops, by feeding the crops on the farm and returning the resulting manure to the land, or, as an alternative, by ploughing under suitable green crops. Pending the development of mixed farming in Rhodesia, the greater consumption of produce on the farm and the return of the manure to the land, the amount of manure produced on the average farm is, under present conditions, sufficient only for a small acreage of the land under cultivation each year; hence recourse should be made to green manuring on the average agricultural holding. The arable farmer must not, however, lose sight of the fact that a nodule-bearing legume, when ploughed under, whilst enriching the soil in humus and nitrogen, does not increase the store of phosphoric oxide and potash. Deep-rooted green manuring crops will bring within the range of more shallow-rooted crops some of the phosphoric oxide and potash present in the sub-soil, but inherent deficiencies in phosphoric oxide and potash are not corrected at all by green manuring, consequently any lack of one or both of those constituents in the soil must be corrected by the direct application of fertilisers containing phosphates or potash as required.\*

The foregoing observations will explain the object of carrying out a series of field trials to ascertain the effect of fertilisers, both alone and in conjunction with green manure, and of green manure alone, upon crop production.

The results obtained in field trials being influenced very largely by the amount and distribution of the seasonal rainfall, the following particulars are given of the rainfall at the Agricultural Experiment Station, Salisbury, during the four seasons 1919-20 to 1922-23 (the number in brackets after each monthly rainfall denotes the number of days in the month on which rain fell):—

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\* For further information on this subject, see Bulletin No. 399, "Green Manuring and Soil Management," issued by the Department of Agriculture, Salisbury.

|                                            | Season<br>1919-20 | Season<br>1920-21 | Season<br>1921-22 | Season<br>1922-23 |
|--------------------------------------------|-------------------|-------------------|-------------------|-------------------|
| September ...                              | ...               | ...               | ...               | .07 (1)           |
| October ...                                | 2.01 (6)          | .38 (5)           | 2.33 (6)          | 1.23 (9)          |
| November ...                               | 5.01 (10)         | 2.01 (8)          | 2.81 (6)          | 4.98 (15)         |
| December ...                               | 8.53 (11)         | 6.66 (14)         | 4.36 (12)         | 5.58 (14)         |
| January ...                                | 5.05 (19)         | 4.87 (14)         | .96 (3)           | 7.36 (20)         |
| February ...                               | 10.39 (20)        | 9.24 (16)         | 4.63 (11)         | 9.66 (18)         |
| March ...                                  | 5.36 (12)         | 6.51 (18)         | 1.73 (6)          | 11.97 (23)        |
| April ...                                  | .09 (2)           | .73 (5)           | ...               | .51 (2)           |
| May ...                                    | 1.01 (4)          | 3.00 (7)          | .27 (1)           | 1.33 (3)          |
| June ...                                   | .09 (3)           | ...               | .02 (1)           | ...               |
| July ...                                   | ...               | .08 (1)           | .06 (2)           | ...               |
| Total rainfall in inches<br>for season ... | 37.54             | 33.48             | 17.17             | 42.69             |

The red dolerite loam, on which the trials were conducted, is typical of that which is generally classified in Rhodesia as average red maize land. The land under trial was first broken in 1909 and carried a variety of crops (unmanured) from 1910 to 1919. Commencing from the season 1919-20, all the plots have been planted to maize every season (except when under green manuring crop as shown in plan).

The chemical composition of the soil (first nine inches) in 1919 (Lab. No. 179/189G) was as follows:—

#### COMPOSITION OF AIR-DRIED FINE EARTH

(Portion passing through 3 mm. sieve).

For determinations other than "loss on ignition," sample treated with hydrochloric acid (sp. gr. 1.12) and digested for forty-eight hours on a water bath.

|                                     |     |        |
|-------------------------------------|-----|--------|
| Total loss on ignition* ...         | ... | 14.60  |
| Silica and refractory silicates ... | ... | 46.44  |
| Ferric oxide and alumina ...        | ... | 38.74  |
| Lime (CaO) ...                      | ... | 0.12   |
| Magnesia (MgO) ...                  | ... | 0.06   |
| Phosphoric oxide ...                | ... | 0.06   |
| Potash (K <sub>2</sub> O) ...       | ... | 0.20   |
|                                     |     | 100.22 |

\* Containing nitrogen 0.122.

Soluble in 1 per cent. citric acid solution. 100 grms. fine earth extracted with 1,000 c.cs. 1 per cent. citric acid solution for one week.

|                               |                  |
|-------------------------------|------------------|
| Phosphoric oxide ...          | 0.0011 per cent. |
| Potash (K <sub>2</sub> O) ... | 0.0203 per cent. |

The following particulars are given regarding the preparation and after-cultivation of the land under trial each season:—

1919-20.—Ploughed once during July. Velvet beans were sown 1st and 2nd December on sections 8, 9 and 10. (See plan, Table I.) Maize sown 3rd and 4th December on sections 5, 6 and 7. Velvet beans ploughed under 29th March. During the season, sections 5, 6 and 7 were cultivated once and hand hoed.

1920-21.—Ploughed once to average depth of 7 inches, disc harrowed once, clod-crushed twice and drag-harrowed once. Maize sown on all sections 5 to 10 on 18th and 19th November. Crop was cultivated three times and once hand hoed.

1921-22.—Ploughed once during July to average depth of 8 inches. Clod-crushed twice, disc-harrowed once, drag-harrowed once. Maize sown on all sections on 29th and 30th November. Crop cultivated twice and hand hoed once.

1922-23.—Ploughed during July. Clod-crushed behind plough. Spring-tooth harrowed and clod-crushed again. Drag-harrowed before sowing. Maize sown on all sections on 5th and 6th December. Crop twice cultivated and twice hand hoed.

The seed used each season was hand-shelled Salisbury White grown on the Government Experiment Farm, Gwebi. The seed was planted by hand, the distance of planting being 40 inches between the rows and 18 inches between the plants in the row. For planting, furrows 3 inches deep were opened up, the seed was planted and the furrows filled in. On those plots receiving fertiliser the dressing was applied by hand along the furrows before the seed was planted.

For comparative trials, it is obviously very important that the stand of plants should be as perfect as possible as well as even on all plots. In these trials the stand on every plot was 97 per cent. to 98 per cent. each season.

The size and arrangement of the plots, the details of the manurial treatment applied to each plot and the yield of grain obtained from each plot over the four seasons 1919-20 to 1922-23 are set forth in the following table:—

TABLE I.—MAIZE MANURIAL TRIALS, SEASONS 1919-20 TO 1922-23.

## PLAN OF MANURIAL TREATMENTS.

| Section No. | 5                                                                                | 6 | 7 | 8 | 9 | 10 |
|-------------|----------------------------------------------------------------------------------|---|---|---|---|----|
| Year 1919   | Application of complete fertiliser NPK (1). Control plot, no manurial treatment. |   |   |   |   |    |
| Year 1920   | No manurial treatment.                                                           |   |   |   |   |    |
| Year 1921   | Manured as per plan below.                                                       |   |   |   |   |    |
| Year 1922   | No manurial treatment.                                                           |   |   |   |   |    |

## ARRANGEMENT OF MANURIAL TREATMENTS, SEASON 1921-22. (O = unmanured.)

| Section No. | 5                                                            | 6                                                                 | 7                                                    | 8                                                    | 9                                                                 | 10                                                                    |
|-------------|--------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------|-----------------------------------------------------------------------|
|             | (1)                                                          | (2)                                                               | (1)                                                  | (2)                                                  | (1)                                                               | (2)                                                                   |
| A           | Bone dust and superphosphate BP.<br>10,208 lb.<br>(51 bags). | O<br>Complete fertiliser NPK (2).<br>11,610 lb.<br>(58 bags).     | O<br>(never manured).<br>8,662 lb.<br>(43 1-3 bags). | O<br>(never manured).<br>7,994 lb.<br>(40 bags).     | Complete fertiliser NPK (2).<br>10,960 lb.<br>(54 4-5 bags).      | O<br>10,078 lb.<br>(50 2-5 bags).                                     |
|             | This section was discarded owing to unevenness.              |                                                                   |                                                      |                                                      |                                                                   | O<br>Bone dust and superphosphate BP.<br>10,682 lb.<br>(53 2-5 bags). |
| B           | O<br>9,032 lb.<br>(45 1-6 bags).                             | O<br>Complete fertiliser NPK (2).<br>11,124 lb.<br>(55 3-5 bags). | O<br>(never manured).<br>7,624 lb.<br>(38 1-8 bags). | O<br>(never manured).<br>7,918 lb.<br>(39 3-5 bags). | O<br>Complete fertiliser NPK (2).<br>10,056 lb.<br>(50 1-4 bags). | O<br>10,474 lb.<br>(52 2-5 bags).                                     |
|             |                                                              |                                                                   |                                                      |                                                      |                                                                   | Bone dust and superphosphate BP.<br>12,014 lb.<br>(60 1-10 bags).     |

As indicated in plan, the size of each plot in seasons 1919-20 and 1920-21 was one section ( $\frac{1}{2}$ -acre). Commencing season 1921-22, each section was divided into four plots of  $\frac{1}{4}$ -acre. On each  $\frac{1}{4}$ -acre plot of sections 5, 6, and 7 is stated the total yield of grain (per acre) obtained during the four seasons 1919-20 to 1922-23. On sections 8 and 10 as shown in plan, a green manuring crop (velvet beans) was grown and ploughed in and the yield stated on each of the plots of those sections is that obtained in the three seasons 1920-21 to 1922-23. As the  $\frac{1}{4}$ -acre sections were not sub-divided until 1921, the yield (per acre) from each sub-section in the first two seasons is taken to be that obtained from the whole section.

### PARTICULARS OF FERTILISER DRESSINGS.

SEASON 1919-20. *Complete fertiliser NPK (1).* This dressing consisted of the following mixture per acre :—30 lbs. nitrate of potash, 10 lbs. nitrate of soda and 180 lbs. medium grade superphosphate (15%). Double superphosphate, on account of its high concentration and the consequent saving of freight per unit of phosphoric oxide, can be landed in Rhodesia this year at a relatively cheaper price than the less concentrated forms of superphosphate. Neither double superphosphate nor sulphate of potash was obtainable in 1919 owing to the war, consequently superphosphate (15%) was used as the source of phosphoric oxide in the mixture, and potash was supplied as nitrate of potash. The substituted mixture was equivalent to the following :—

|                                                    |                                                        |      |
|----------------------------------------------------|--------------------------------------------------------|------|
| 36 lbs. nitrate of soda (15.5% N).                 | Percentage amounts of Nitrogen ...                     | 4.3  |
| 67 lbs. double superphosphate (40%).               | fertilising ingredients Water-soluble phosphoric oxide | 20.6 |
| 27 lbs. sulphate of potash (50% K <sub>2</sub> O). | in mixture ... Potash ...                              | 10.4 |

— 130 lbs. per acre.

SEASON 1921-22. *Complete fertiliser NPK (2).* This dressing consisted of the following mixture per acre :—

|                                                     |                                                        |      |
|-----------------------------------------------------|--------------------------------------------------------|------|
| 25 lbs. nitrate of soda (15.5% N).                  | Percentage amounts of Nitrogen ...                     | 4.4  |
| 50 lbs. double superphosphate (40%).                | fertilising ingredients Water-soluble phosphoric oxide | 22.8 |
| 12½ lbs. sulphate of potash (48% K <sub>2</sub> O). | in mixture ... Potash ...                              | 6.8  |

— 87½ lbs. per acre.

*Bone and superphosphate B.P.* This dressing consisted of the following mixture per acre :—

|                                |                                                      |      |
|--------------------------------|------------------------------------------------------|------|
| 150 lbs. bone dust.            | Percentage amounts of Water-soluble phosphoric oxide | 4.7  |
| 20 lbs. double superphosphate. | fertilising ingredients Total phosphoric oxide       | 24.7 |
| — 170 lbs. per acre.           | in mixture ... Nitrogen ...                          | 3.9  |

*Bone dust B.* This dressing consisted of 175 lbs. of bone dust per acre.

From the particulars given in Table I. it will be noted that the size of each plot in the first two seasons was half an acre, and that each half-acre was then sub-divided into four parts of one-eighth acre each. As some farmers may think that one-eighth acre plots are too small for practical purposes, it may be well to consider the question briefly. Sir Daniel Hall, at one time Director of the far-famed Rothamsted Agricultural Experiment Station, and now of the Ministry of Agriculture, England, refers to this question in his book on "Fertilisers and Manures," and states as follows:—"The size of experimental plots is a matter on which there are considerable differences of opinion. On the one hand, large plots smooth out the small irregularities due to minor differences of soil and drainage, insect attacks and preparation of the land; errors of weighing and measuring are also proportionally reduced by being spread over the larger quantities involved. On the other hand, the larger plots mean greater risks of meeting with irregular patches of soil, and much greater difficulty is experienced in getting the cultivation of all the plots carried out under uniform conditions. It is of the first importance that the whole of the experimental land should be worked on the same day; otherwise if part of the land is worked and left and then the weather changes, a considerable interval may elapse before the operation can be completed, and a new factor, often of considerable magnitude, is thus introduced into the results." Sir Daniel Hall proposes a size of one-twentieth of an acre, having several plots for each manurial treatment. Numerous other authorities can be quoted in support of the view that one-eighth acre plots are not too small for practical purposes.

The total yield of grain (per acre) obtained from each plot over the four seasons in the case of sections 5, 6 and 7, and over three seasons from sections 8 and 10, is given in Table I. in order to indicate the degree of evenness of the returns obtained from those plots receiving similar treatment. On section 9 the plots originally laid down were intended to be duplicates of those on section 10, but it was subsequently found that that section had to be discarded owing to the presence of a richer patch of ground in the centre of it.

In order to ascertain more clearly the effect of the various manurial treatments upon the crop return, the following table (Table II.) has been prepared from the data given in Table I., and sets forth the manurial treatment with its present cost at Salisbury (1923 prices); the total yield of grain obtained in four seasons 1919-20 to 1922-23 from each of the plots on sections 5 and 6, and in three seasons 1920-21 to 1922-23 from each of the plots on sections 8 and 10, together with the amount by which the average yield from plots receiving the same manurial treatment exceeded that obtained during the four seasons from the continuous maize (unmanured) plots:—

TABLE II.

Summary of manurial treatments and their effects upon the yield of maize (for details of manurial treatments, see Table I.).

The basis taken for determining the effect of each manurial treatment upon the yield of grain compared with continuous cropping without farm manure or fertiliser treatment is the total yield of grain per acre, viz., 8,030 lbs., obtained from four crops of maize grown on section 7 in seasons 1919-20 to 1922-23 without manurial treatment.

| Manurial treatment.    | Total cost of fertiliser treatment at Salisbury (1923 prices), excluding cost of mixing and application per acre. |    |    | Section and plot Nos. | Total yield of grain per acre.             | Average yield of grain per acre from each treatment. | Average increased return of grain over controls (unmanured) per acre. |
|------------------------|-------------------------------------------------------------------------------------------------------------------|----|----|-----------------------|--------------------------------------------|------------------------------------------------------|-----------------------------------------------------------------------|
| "NPK (1)" applied 1919 | ...                                                                                                               | £  | s. | d.                    | Lbs.<br>9,588<br>9,032<br>10,482<br>10,152 | Lbs.<br>}                                            | Lbs.<br>}                                                             |
|                        |                                                                                                                   | 1  | 3  | 8                     |                                            |                                                      |                                                                       |
|                        |                                                                                                                   |    |    |                       |                                            |                                                      |                                                                       |
|                        |                                                                                                                   |    |    |                       |                                            |                                                      |                                                                       |
| "NPK (1)" applied 1919 | ...                                                                                                               | 1  | 3  | 8                     | Lbs.<br>11,124<br>11,610                   | }                                                    | 3,317†                                                                |
| "NPK (2)" applied 1921 | ...                                                                                                               | 0  | 15 | 11                    |                                            |                                                      |                                                                       |
|                        |                                                                                                                   | £1 | 19 | 7                     |                                            |                                                      |                                                                       |
| "NPK (1)" applied 1919 | ...                                                                                                               | £2 | 5  | 3                     | Lbs.<br>10,208<br>10,740                   | }                                                    | 2,424†                                                                |
|                        |                                                                                                                   |    |    |                       |                                            |                                                      |                                                                       |
|                        |                                                                                                                   |    |    |                       |                                            |                                                      |                                                                       |
|                        |                                                                                                                   |    |    |                       |                                            |                                                      |                                                                       |
| "BP" applied 1921      | ...                                                                                                               |    |    |                       |                                            |                                                      |                                                                       |

\* Total yield of grain in four seasons (1919-20 to 1922-23).

† Combined increased return of grain over average return from controls (unmanured) in seasons 1919-20 to 1922-23.

TABLE II.—*continued.*

| Manurial treatment.                               | Total cost of fertilizer treatment at Salisbury (1923 prices), excluding cost of mixing and application per acre. | Section and plot Nos.                      | Total yield of grain per acre.               | Average yield of grain per acre from each treatment. | Average increased return of grain over controls (unmanured) per acre. |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------|----------------------------------------------|------------------------------------------------------|-----------------------------------------------------------------------|
| Green manuring, 1919-20                           | £ s. d.<br>...                                                                                                    | 8 A (2)<br>8 B (1)<br>10 A (2)<br>10 B (1) | Lbs.<br>10,078<br>10,056<br>10,682<br>10,474 | Lbs.<br>10,322 <sup>†</sup>                          | Lbs.<br>2,272§                                                        |
| Green manuring, 1919-20<br>"NPK (2)" applied 1921 | ...<br>0 15 11                                                                                                    | 8 A (1)<br>8 B (2)                         | 10,960<br>11,418                             | 11,189 <sup>†</sup>                                  | 3,139§                                                                |
| Green manuring, 1919-20<br>"BP" applied 1921      | ...<br>1 1 7                                                                                                      | 10 B (2)                                   | 12,014                                       | 12,014 <sup>†</sup>                                  | 3,964§                                                                |
| Green manuring, 1919-20<br>"B" applied 1921       | ...<br>1 1 0                                                                                                      | 10 A (1)                                   | 11,804                                       | 11,804 <sup>†</sup>                                  | 3,754§                                                                |

† Total yield of grain in three seasons (1920-21 to 1922-23).

§ Combined increased return of grain in three seasons (1920-21 to 1922-23) over average return from controls during four seasons (1919-20 to 1922-23).



The information gathered from the above table is as follows:—

(1) One application of a complete fertiliser—NPK (1)—applied in 1919, and costing to-day 23s. 8d. per acre at Salisbury (exclusive of cost of mixing and application), effected an average increased return of maize over the return obtained from unmanured land during the four seasons 1919-20 to 1922-23 amounting in the aggregate to 1,763 lbs. per acre, or 8.8 bags (200 lbs. grain), the outlay in fertiliser per bag increase working out at 2s. 8½d.

(2) Two applications of complete mixtures, viz., NPK (1) applied in 1919 and NPK (2) in 1921, costing altogether 39s. 7d. per acre to-day at Salisbury (cost of mixing and application not included), effected an average increased return of maize over unmanured land during the four seasons 1919-20 to 1922-23 amounting in the aggregate to 3,317 lbs. per acre, or 16½ bags, the outlay in fertiliser per bag increase working out at 2s. 5d.

Attention is directed to the percentage amounts of fertilising ingredients in these "complete" mixtures NPK (1) and NPK (2), particulars of which will be found in Table I. The chief difference between the two mixtures as regards those amounts lies in the proportion of potash, the NPK (2) mixture containing a much smaller amount. The NPK (2) dressing per acre supplied a lighter application of nitrogen and phosphoric oxide than dressing NPK (1) and a still lighter application of potash. The fact that the average increased return of maize effected by the NPK (2) dressing applied in 1921 was 1,554 lbs. (3,317 — 1,763 lbs.) over that effected by dressing NPK (1) alone applied in 1919, which is only 209 lbs. less than the increased return over the unmanured land effected by NPK (1) alone, indicates that the soil is not very markedly in need of potash, a deduction which is supported by the chemical analysis of the soil.

(3) One application of complete fertiliser—NPK (1)—applied in 1919, supplemented by an application of bone and superphosphate—BP—applied in 1921, costing altogether 45s. 3d. per acre to-day at Salisbury (exclusive of cost of mixing and application), effected an average increased return of maize over the unmanured land during the four seasons 1919-20 to 1922-23 amounting in the aggregate to 2,424 lbs. per acre, or 12.1 bags, the outlay in fertiliser per bag increase working out at 3s. 9d.

It will be noted that each of the plots receiving this manurial treatment gave somewhat higher aggregate yields than the "NPK (1) alone" plots on their respective sections, but that the plot on section 5 gave a lower aggregate return than one of the "NPK (1) alone" plots on section 6. Slight inequalities of ground are inevitable, but it serves to show that the effect of the supplementary dressing of bone and superphosphate did not cause a marked improvement in yield. Reference will be made to this circumstance later.

(4) The improvement effected by green manuring with velvet beans in 1919-20 without any supplementary manurial treatment was such that the average aggregate return of maize produced in the three seasons 1920-21 to 1922-23 was 2,272 lbs. per acre, or 11½ bags, in excess of the

average yield per acre obtained in the *four* seasons 1919-20 to 1922-23 from unmanured land.

This result provides the local data necessary to convince the arable farmer of the wisdom of adopting such a system of cropping and treatment of his land as will ensure that the supply of humus in the soil will not be depleted.

(5) Velvet beans grown and ploughed in as a green manure during season 1919-20, supplemented by a dressing of complete fertiliser—NPK (2)—applied in 1921, and costing 15s. 11d. (1923 prices), effected in the three seasons 1920-21 to 1922-23 an average increased return of maize over the aggregate obtained in the four seasons 1919-20 to 1922-23 from the unmanured land amounting to 3,139 lbs. per acre, or 15.6 bags. The increased yield over the three seasons' average return from all the green manured plots which received no supplementary fertiliser treatment was 867 lbs. per acre, or 4.3 bags; thus the improvement effected by the supplementary dressing of complete fertiliser has been such that the outlay in fertiliser per bag increase works out at 3s. 8d.

There was, however, a difference in yield per acre of 511 lbs. in favour of the green manured plots which received no supplementary fertiliser treatment on section 10 compared with the corresponding plots on section 8, indicating that the soil of section 10 may be slightly better than that of section 8. If we compare the average yields of the green manured plots which received complete fertiliser in 1921 with the adjoining green manured plots on the same section (8) which received no fertiliser treatment, we find that the complete fertiliser dressing effected an increase of 1,122 lbs. per acre, or 5.6 bags, and that the outlay in fertiliser per bag increase works out at 2s. 10d.

(6) Velvet beans ploughed in as green manure during season 1919-20, supplemented by a dressing of bone and superphosphate—BP—applied in 1921, and costing 21s. 7d. (1923 prices), effected in the three seasons 1920-21 to 1922-23 an average increased return of maize over the aggregate obtained in the four seasons 1919-20 to 1922-23 from the unmanured land amounting to 3,964 lbs. per acre, or 19.8 bags. The increase over the average return in the three seasons from all the green manured land which received no supplementary fertiliser treatment was 1,692 lbs. per acre, or 8.4 bags; thus the improvement effected by the supplementary dressing of bone and superphosphate has been such that the outlay in fertiliser per bag increase works out at 2s. 7d.

It is unfortunate that more plots of this supplementary treatment are not available; as already stated, a duplicate plot was laid down on section 9, but that section had to be abandoned owing to unevenness of ground. It so happens, however, that the bone and superphosphate treatment has been very much like the treatment with bone meal alone as regards the amount of phosphoric oxide supplied per acre, the former supplying 41 lbs. of phosphoric oxide per acre, 8 lbs. of which were applied in water-soluble form as superphosphate, whilst the latter supplied 38½ lbs. phosphoric oxide per acre. It is interesting to note that the increased return on the green manured plots which received

a supplementary dressing of bone dust—B—applied in 1921 gave an increased return over that obtained from the unmanured land amounting altogether to 3,754 lbs. per acre, or 18.8 bags. The improvements in yield effected by the bone and superphosphate and the bone dust treatments therefore corroborate each other.

The increased return of maize over the three seasons 1920-21 to 1922-23 from the green manured plots receiving a dressing of bone dust in 1921 over the average yield from all the green manured plots which received no supplementary fertiliser treatment was 1,482 lbs. per acre, or 7.4 bags; thus the improvement effected by the supplementary dressing of bone dust, costing 21s. per acre (1923 prices), has been such that the outlay in fertiliser per bag increase works out at 2s. 10d.

Attention has been drawn to the fact that the yield from the green manured plots which received no supplementary fertiliser treatment on section 10 was slightly higher than that from the corresponding plots on section 8. If we compare the yields from the green manured plots which received "bone and superphosphate" and bone dust respectively in 1921 with the average yield from the adjoining green manured plots on the same section which received no fertiliser treatment, we find (a) that the bone and superphosphate dressing effected an increase of 1,436 lbs. per acre, or 7.1 bags, and that the outlay in fertiliser per bag increase works out at 3s. 0½d.; and (b) that the bone dust dressing effected an increase of 1,226 lbs. per acre, or 6.1 bags, and that the outlay in fertiliser per bag increase works out at 3s. 5d.

#### FERTILITY OF THE RED LAND UNDER EXPERIMENT AT THE END OF THE FOUR YEARS' TRIAL.

In order to study the relative values of using fertilisers alone, of green manuring alone and of green manuring in conjunction with fertiliser for maintaining the fertility of the soil, the average crop returns obtained *each season* from the control (unmanured) land and from that under each manurial treatment are set forth in the following table:—

TABLE III.  
Manurial treatments and average crop returns obtained during each of the four seasons 1919-20 to 1922-23.

| Section and plot Nos.                         | Season. | Manurial treatment.                  | Crop returns per acre. |                                           |                         |                                        | Proportion of stover to grain (grain = 100). | Proportion of cobs (cobs to grain = 100). |
|-----------------------------------------------|---------|--------------------------------------|------------------------|-------------------------------------------|-------------------------|----------------------------------------|----------------------------------------------|-------------------------------------------|
|                                               |         |                                      | Grain.<br>lbs.         | Stover<br>(stalks and<br>leaves).<br>lbs. | Cobs<br>(cobs).<br>lbs. | Total crop<br>above<br>ground.<br>lbs. |                                              |                                           |
| {<br>7 A (1)<br>7 A (2)<br>7 B (1)<br>7 B (2) | 1919-20 | Continuous control (unmanured) plots | 2820                   |                                           |                         |                                        |                                              |                                           |
|                                               | 1920-21 | " "                                  | 3044                   |                                           |                         |                                        |                                              |                                           |
|                                               | 1921-22 | " "                                  | 1298                   | 1470                                      | 234                     | 3002                                   | 113.2                                        | 18.0                                      |
|                                               | 1922-23 | " "                                  | 888                    | 1802                                      | 162                     | 2652                                   | 202.9                                        | 18.2                                      |
| {<br>5 A (2)<br>5 B (1)<br>6 A (2)<br>6 B (1) | 1919-20 | " "                                  | 8050                   |                                           |                         |                                        |                                              |                                           |
|                                               | 1920-21 | "NPK (1)" dressing                   | 3220                   |                                           |                         |                                        |                                              |                                           |
|                                               | 1921-22 | Nil ...                              | 3697                   | 1873                                      | 305                     | 3908                                   | 108.2                                        | 17.6                                      |
|                                               | 1922-23 | Nil ...                              | 1166                   | 1958                                      | 206                     | 3330                                   | 167.9                                        | 17.6                                      |
| {<br>5 B (2)<br>6 A (1)                       | 1919-20 | "NPK (1)" dressing                   | 9813                   |                                           |                         |                                        |                                              |                                           |
|                                               | 1920-21 | Nil ...                              | 3220                   |                                           |                         |                                        |                                              |                                           |
|                                               | 1921-22 | "NPK (2)" dressing                   | 3697                   | 2237                                      | 406                     | 5053                                   | 92.8                                         | 16.8                                      |
|                                               | 1922-23 | Nil ...                              | 2040                   | 2752                                      | 340                     | 5132                                   | 134.9                                        | 16.6                                      |
| {<br>5 A (1)<br>6 B (2)                       | 1919-20 | "NPK (1)" dressing                   | 11367                  |                                           |                         |                                        |                                              |                                           |
|                                               | 1920-21 | Nil ...                              | 3220                   |                                           |                         |                                        |                                              |                                           |
|                                               | 1921-22 | "BP" dressing                        | 3697                   | 2148                                      | 332                     | 4397                                   | 112.0                                        | 17.3                                      |
|                                               | 1922-23 | Nil ...                              | 1640                   | 2980                                      | 280                     | 4300                                   | 145.1                                        | 17.0                                      |
|                                               |         |                                      | 10474                  |                                           |                         |                                        |                                              |                                           |

TABLE III.—continued.

| Section and plot Nos.                        | Season. | Manurial treatment.             | Crop returns per acre. |                                           |                          |                                        | Proportion of cobs (cores) to grain (grain = 100). | Proportion of cobs (cores) to grain (grain = 100). |
|----------------------------------------------|---------|---------------------------------|------------------------|-------------------------------------------|--------------------------|----------------------------------------|----------------------------------------------------|----------------------------------------------------|
|                                              |         |                                 | Grain.<br>lbs.         | Stover<br>(stalks and<br>leaves).<br>lbs. | Cobs<br>(cores).<br>lbs. | Total crop<br>above<br>ground.<br>lbs. |                                                    |                                                    |
| { 8 A (2)<br>8 B (1)<br>10 A (2)<br>10 B (1) | 1919-20 | Green manured with velvet beans | —                      |                                           |                          |                                        |                                                    |                                                    |
|                                              | 1920-21 | Nil                             | 5040                   | 2077                                      | 369                      | 4576                                   | 97.5                                               | 17.3                                               |
|                                              | 1921-22 | Nil                             | 2130                   | 4156                                      | 478                      | 7786                                   | 131.8                                              | 15.1                                               |
|                                              | 1922-23 | Nil                             | 3152                   |                                           |                          |                                        |                                                    |                                                    |
|                                              |         |                                 | 10322                  |                                           |                          |                                        |                                                    |                                                    |
| { 8 A (1)<br>8 B (2)                         | 1919-20 | Green manured with velvet beans | —                      |                                           |                          |                                        |                                                    |                                                    |
|                                              | 1920-21 | Nil                             | 5016                   | 2552                                      | 424                      | 5525                                   | 100.1                                              | 16.6                                               |
|                                              | 1921-22 | "NPK (2)" dressing              | 2549                   | 4780                                      | 512                      | 8916                                   | 131.9                                              | 14.1                                               |
|                                              | 1922-23 | Nil                             | 3624                   |                                           |                          |                                        |                                                    |                                                    |
|                                              |         |                                 | 11189                  |                                           |                          |                                        |                                                    |                                                    |
| 10 B (2)                                     | 1919-20 | Green manured with velvet beans | —                      |                                           |                          |                                        |                                                    |                                                    |
|                                              | 1920-21 | Nil                             | 5064                   | 2628                                      | 484                      | 5966                                   | 92.0                                               | 16.9                                               |
|                                              | 1921-22 | "BP" dressing                   | 2854                   | 4960                                      | 616                      | 9672                                   | 121.1                                              | 15.0                                               |
|                                              | 1922-23 | Nil                             | 4096                   |                                           |                          |                                        |                                                    |                                                    |
|                                              |         |                                 | 12014                  |                                           |                          |                                        |                                                    |                                                    |
| 10 A (1)                                     | 1919-20 | Green manured with velvet beans | —                      |                                           |                          |                                        |                                                    |                                                    |
|                                              | 1920-21 | Nil                             | 5064                   | 2380                                      | 460                      | 5572                                   | 87.1                                               | 16.8                                               |
|                                              | 1921-22 | "B" dressing                    | 2732                   | 5008                                      | 544                      | 9560                                   | 124.9                                              | 13.5                                               |
|                                              | 1922-23 | Nil                             | 4008                   |                                           |                          |                                        |                                                    |                                                    |
|                                              |         |                                 | 11804                  |                                           |                          |                                        |                                                    |                                                    |

In comparing the crop returns obtained from a piece of land over a number of years, account must be taken of seasonal conditions. Earlier in this report, particulars are given of the rainfall returns for the Salisbury Experiment Station during the period under review. In 1919-20 the rains were fairly well distributed over the season, but somewhat heavy during the earlier months. Season 1920-21 was an excellent one. The third season (1921-22) was, however, by far the poorest of the four; not only was the rainfall abnormally small, but the rains which did fall were not well distributed, and during the dry month of January the crop suffered severely. In 1922-23 the rainfall was abnormally heavy; although the rains were well distributed, the season was rather too wet for the best results.

From an examination of the particulars given in Table III, we gather the following information:—

(i.) *Continuous Control (Unmanured) Plots.*—Section 7.—The yield of grain from the unmanured plots fell from an average of 14 bags in 1919-20 to  $4\frac{1}{2}$  bags (approx.) in 1922-23. In common with the fertilised plots, sections 5 and 6, the yield of grain from section 7 in the second season (1920-21) was slightly higher than that obtained in 1919-20, owing doubtless to a better season. Even in the bad season of 1921-22 the yield from the unmanured plots was  $6\frac{1}{2}$  bags per acre. 1922-23, although too wet to be ideal, was a very fair season, and the fact that the land was only capable of yielding  $4\frac{1}{2}$  bags per acre with an almost perfect stand of plants and thorough cultivation shows that it is now practically worked out.

(ii.) *Fertilised Plots.*—Sections 5 and 6.—Under (i.) reasons have been given for the increased yield of grain in season 1920-21 over that obtained in 1919-20. The significant feature as regards the fertilised plots is that the grain returns from 1920-21 to 1922-23 have gradually fallen. On the plots which received one dressing of complete fertiliser, viz., NPK (1), in the four seasons, the yield has fallen from 16 bags in 1919-20 to  $5\frac{3}{4}$  bags per acre in 1922-23. It is obvious, therefore, that the fertility of land similar to that under experiment cannot be satisfactorily maintained by a system of manurial treatment consisting solely of one application of fertiliser every four years.

On the plots which received two dressings of complete fertiliser in the four seasons, viz., NPK (1) in 1919 and NPK (2) in 1921, whilst the supplementary NPK (2) dressing effected an increased return compared with the yield obtained from the NPK (1) plots, which received no supplementary fertiliser treatment in 1921, it is reasonable to assume that the NPK (2) dressing was not able to effect so marked an improvement in the poor season of 1921-22 as it would have done had the weather been more favourable, and that in consequence a greater residual effect from the dressing would be apparent in the following season 1922-23. It is to be observed, however, that the yield of grain in the more favourable season of 1922-23 was less than that of the poor season of 1921-22. That fact and also the further fact that the yield of grain fell from an average of 16 bags per acre in 1919-20 to 10  $\frac{1}{5}$ th bags in 1922-23 indicate that the fertility of the land is not being maintained satisfactorily by applications of complete fer-

tiliser every alternate year, although it can justly be claimed in favour of such manurial treatment that the fall in fertility has been much less marked in the four years than has been the case on those plots which received one complete dressing only or no manurial treatment of any kind during the same period.

The foregoing remarks concerning the plots which received two dressings of complete fertiliser in the four seasons also apply to those plots which received the complete fertiliser NPK (1) in 1919 and "bone and superphosphate" in place of NPK (2) in 1921, with this additional observation: that the bone and superphosphate dressing—BP—was not as effective in increasing the yield of grain as the less costly NPK (2) dressing, from which it is inferred that "complete fertiliser" is more suitable than "bone and superphosphate" for red maize land which has been depleted of humus by constant cultivation without the application of farm manure or green manure.

(iii.) *Green Manured Plots.*—Sections 8 and 10.—The effect of green manuring and of fertilisers in conjunction with green manuring upon immediate crop returns has been dealt with, and facts have been adduced already to indicate clearly the economic importance of adopting such a system of soil treatment as will prevent the exhaustion of humus. In the experiments with which this report deals it has been shown that the land after being green manured with velvet beans has produced in the three succeeding maize crops without fertiliser treatment a grain return which was  $11\frac{1}{2}$  bags in excess of the total yield obtained from four consecutive crops of maize on unmanured land. An examination of Table III. also shows that the total grain return in the *three* years following green manuring was  $2\frac{1}{2}$  bags higher than that obtained in *four* seasons from the land which received a dressing of complete fertiliser in the first season. On the green manured land which received a dressing of fertiliser—either "complete fertiliser," "bone and superphosphate" or "bone dust"—in the second season after green manuring the return of maize in the *three* seasons was for all practical purposes equal to or in excess of the aggregate return over *four* years from land which received two dressings of fertiliser without green manuring.

In the successful management of arable land for permanent agriculture, attention must be directed not only to the immediate effect of a particular cultural treatment upon the crop return, but also to the condition in which the land is left for succeeding crops. When dealing with the fertilised plots on sections 5 and 6 it was noted that the crop returns from those plots in 1922-23 were lower than those obtained in 1921-22, in spite of the former being a much better season. On the green manured plots, however, it will be seen that the crop returns were 5 to 6 bags per acre higher in 1922-23 than in 1921-22, showing that the green manured land was in much better condition and better able to take advantage of the more favourable season. It is also important to note that whereas the land which only received fertiliser treatment produced 6 to  $10\frac{1}{2}$  bags of maize per acre in season 1922-23, the yield obtained from the green manured land varied from  $15\frac{3}{4}$  bags per acre on that which had received no supplementary fertiliser treatment to  $20\frac{1}{2}$  bags on that which had received a dressing of "bone and

superphosphate." The green manured land, whether it had received a supplementary dressing of fertiliser or not, was therefore in a much better state of fertility at the end of the four years than the land which had only received dressings of fertiliser.

(iv.) *Yield of Stover and Cobs (Cores).*—From the particulars supplied in Table III. it will be seen that the weights of stover (stalks and leaves) and of cobs (cores) were determined, as well as the yield of grain, in seasons 1921-22 to 1922-23, and the returns are placed on record for general information.

As is to be expected, the proportions of stover and cobs to grain are subject to much variation, being affected not only by the character of the season, but also by the character and condition of the land on which the crop is grown. The seasonal factor is, however, eliminated when we consider the figures for each season separately, and it is to be observed in general that the better the condition of the land, the lower the proportion of stover and cobs to grain.

### GENERAL CONCLUSIONS.

(1) For the maintenance of the fertility of red maize land under constant cultivation it is essential to dress the land periodically with farm manure, or as a substitute to plough under a suitable green manuring crop in order to preserve the humus content of the soil. The frequency with which such treatment is absolutely necessary will naturally depend to some extent upon the system of cropping. In the series of trials dealt with in this report it has been shown that where the land was cropped with maize for three successive years after the green manuring crop was ploughed under, the yield obtained from the third crop was very satisfactory, and that the total yield of maize in the three seasons 1920-21 to 1922-23 following the season devoted to turning in the green crop (1919-20) was greatly in excess of that obtained in the four seasons 1919-20 to 1922-23 from similar unmanured land.

It is to be inferred, therefore, that the green manuring treatment may be applied profitably every fourth year on red land which is devoted to maize production where kraal or stable manure is not available; and the fact that the green manured land in the trials with which this report deals was still in good condition after the third successive crop of maize indicates that in some cases the fertility of the land will not suffer severely if the green manuring treatment is applied every fifth year instead of every fourth.

The green manuring crop turned under in the trials was velvet beans, and the crop was a heavy one. In that connection it must be borne in mind that the crop grown must not only be suitable for the purpose, but must provide a sufficiently heavy growth of vegetable matter for turning under. Suitable crops for green manuring may vary in luxuriance of growth in different areas. On the red soil at Glendale, for example, Mr. T. J. Mossop, of Protea, reports that velvet beans yield a good return of beans, but produce a poor growth of vine; whereas Sunn hemp grows well and produces a heavy vege-



tative growth. Messrs. Mossop Bros., therefore, prefer Sunn hemp to velvet beans as a green manuring crop on their farm.

(2) The fertility of red maize land cannot be satisfactorily maintained solely by the application of fertilisers.

(3) "Complete fertiliser" is more suitable than "bone and superphosphate" on red maize land which has been depleted of humus by constant cultivation without the application of farm manure or green manure. When using fertiliser in such cases, due regard must be given to conclusion (2).

(4) "Bone and superphosphate," bone dust and "complete fertiliser" can be applied with advantage to the second crop of maize after green manuring.

The series of trials upon which this conclusion is based do not indicate clearly which of those three fertilisers is the most suitable, consequently preliminary trials with each are recommended.

(5) The fertilisers which are recommended for trial in (3) and (4) are as follows:—

(a) *Complete Fertiliser NPK (2).*—Particulars of this mixture and the rate of application are given in Table I. Two concentrated compound fertilisers which contain the fertilising ingredients—nitrogen, water-soluble phosphoric oxide and potash—in the same relative proportions as the NPK (2) mixture are already registered under the Fertilisers, Farm Foods, Seeds and Pest Remedies Ordinance, with the following guaranteed composition: 4 per cent. nitrogen, 20 per cent. water-soluble phosphoric oxide and 6 per cent. potash. A dressing of 100 lbs. of each of those fertilisers is equivalent to the NPK (2) dressing per acre specified in Table I. Buyers who prefer it can therefore obtain the prepared mixture instead of buying the ingredients and mixing them on the farm. As stated in Table I., according to present quotations the cost of the NPK (2) dressing, if the mixing is done on the farm, works out at 15s. 11d. per acre at Salisbury. The equivalent dressing of the proprietary mixtures specified above would cost an extra 2s. 6d. to 4s. 6d. per acre.

All fertiliser firms represented on the local market would doubtless supply the ingredients specified in the NPK (2) mixture or a prepared mixture conforming closely thereto.

(b) *Bone and Superphosphate Mixture.*—Particulars of this mixture and the rate of application are given in Table I. On account of the fineness of bone dust, the preparation of this mixture on the farm is not a pleasant undertaking, consequently buyers who prefer to do so can obtain proprietary bone and superphosphate mixtures quoted locally.

(c) *Bone Dust.*—Particulars of the rate of application per acre are given in Table I.

*Preparation of Fertiliser Mixtures on the Farm.*—If mixtures of fertilisers are prepared on the farm, the procedure to adopt is as follows:—Break down each fertiliser to a condition fine enough to pass through a sieve having about eight meshes to the linear inch (it

will be found that some fertilisers are already in sufficiently fine condition). That fertiliser which will be present in the mixture in the largest quantity should be spread on the floor (a cement floor if possible) to a uniform depth and the remaining ingredients spread over the heap in layers of uniform thickness. The heap should then be turned over with square-faced shovels several times until a uniform mixture has been obtained. Not more than one ton should be prepared at each mixing.

*Method of Application of Fertiliser.*—For the maize crop, application at the time of planting by means of a fertiliser attachment to the planter affords a convenient method of application. It generally pays to purchase approved fertilisers of high concentration in Rhodesia in order to save on freight charges, and concentrated fertilisers containing superphosphate are apt to work into a paste in the hopper of a fertiliser attachment. This can be obviated to a great extent if the fertiliser is dry at the time of application, and still more so by thoroughly mixing the concentrated fertiliser with an equal weight of fine dry earth and adjusting the rate of application accordingly. Broadcasting the fertiliser by machine or by hand in calm weather, and harrowing it in with a disc harrow before planting, has also proved satisfactory. To broadcast evenly by hand, however, requires practice. Whatever method of application is adopted, the fertiliser should be well covered by the soil. Application of the fertiliser dressing after the maize plants are above ground is not recommended.

*Acknowledgments.*—To ensure accuracy in the preparation and application of the fertiliser dressings, planting and harvesting of the crops, etc., a large amount of work involving very close attention to detail has been called for in carrying out the trials which are dealt with in this report. The writer expresses acknowledgments to his staff for assistance rendered and to the Chief Agriculturist for the services of Mr. Arnold, assistant in charge at the Salisbury Experiment Station, whose assistance in the field work is also acknowledged.

## From Breeder to Butcher.

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CATTLE FEEDING EXPERIMENT No. 13.

GOVERNMENT EXPERIMENT FARM, GWEBI.

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By ERIC A. NOBBS, Ph.D., B.Sc.

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The basis of fattening cattle at the Government farm, Gwebi, since these experiments were commenced in 1915 having now become fairly definitely fixed, it was decided to conduct a series of feeding demonstrations in which the same ration is given to a number of pens of grade cattle, representing the principal beef breeds at present in use in Southern Rhodesia—Shorthorn, Hereford, Devon, Sussex and Aberdeen Angus.

The proposal was put before a number of farmers interested in the subject of stall feeding of cattle, and was also submitted to the Mashonaland Farmers' Association for an opinion as to its usefulness and desirability. It was generally recognised to be instructive and calculated to awaken interest in this very important subject, and to be of the nature of a demonstration rather than strictly an experiment.

The stall feeding of grade cattle of beef breeds aims at securing the best prices possible for cattle and at the same time of turning to advantage those crops and portions of crops which are not directly marketable, incidentally also providing a much-needed supply of farm-yard manure. It is essentially therefore a subject of interest to the man engaged upon mixed agriculture, intensive arable farming, coupled with the rearing of a superior class of stock. Such farms are to be found in all parts of Southern Rhodesia, the stall feeding of cattle being now a growing practice not only in the maize belt *par excellence*, but also round Bulawayo, in the Midlands and in Victoria.

It must at the outset be made clear that the results can never be regarded as a test of the relative merits of the different breeds. The reasons for this are obvious, but may be mentioned. The cattle employed do not all emanate from the same kind of foundation stock, which may originally have been native to Southern Rhodesia, or from Northern Rhodesia, Nyasaland, the Cape and Angoniland. The original stock, even if of the same breed, may also have varied in

quality. The number of crosses of English beef breeds used vary; some are first crosses, others are even the third cross of the same breed. It cannot be certain that only one English breed has been used in grading up; thus Cape Shorthorn grades may have been used with Hereford bulls, and so on. The quality of the bulls cannot possibly in all cases have been the same. The treatment of the stock prior to fattening has probably differed in every instance. By selecting typical examples of each grade and the best fattening oxen of those available, it may be claimed that as good representatives as were available were used, but supporters of each breed can contend that even better specimens might have been obtained, and this could never be contradicted. The comparison is liable to arouse considerable feeling amongst supporters of different breeds. It cannot be affirmed that every lot of grade bullocks chosen was equal to the best of their kind that could be obtained. Hence it is essential to give the history and describe the breeding of each lot. For such a test we have the analogies of the thousand guinea trophy, the Smithfield and other similar Christmas shows, the egg-laying tests and any athletic sports in which the victory does not imply final and permanent superiority.

The scale of feeding was precisely the same per 1,000 lbs. of live weight, not per head nor per pen. The composition of the ration was based on past experience, but using such foodstuffs as were available. This season, majordas being a failure and velvet beans scarce, the former were omitted, and silage, pumpkin and mangold used in relatively larger quantities and more manna hay and ground nut hay than would otherwise have been the case.

The cattle selected were all of a type suitable for stall feeding. In addition, a pen representative of what would not be selected as likely to fatten profitably has, for comparison, been fed on identically the same ration in order to compare the results on good stock and on scrubs, both, however, being grade stock. Forty-two bullocks were fattened, all commencing on the same day, and were sold when appearance and weight showed they were finished. Each pen consisted of seven head of grade oxen showing predominantly the character of Shorthorn, Hereford, Devon, Aberdeen Angus and Sussex, selected from herds of well known supporters of each breed.

Mr. J. O. A. Fraser-Mackenzie, of the Lone Cow Estate, Lomagundi, supplied the Hereford grades, which showed strongly the characteristics of that breed and were in good condition. The average initial weight was 904 lbs., and varied from 1,079 lbs. to 777 lbs. They are, therefore, the lightest in weight, except the scrubs. They were all full mouth, or three years old and upwards. These *Herefords* were a typical ranch lot, and all in good condition. Owing to misadventure in bringing them from their distant home, when several of those first selected broke away and had to be replaced hurriedly with poorer specimens, they were not quite as nice a lot as they might have been, but even so they gave a good account. Reared on the rich pastures on the west side of the Umvukwe Hills, these cattle walked about 25 miles, and then came by train and were at once placed in the feeding pens.

The Rhodes Inyanga Estate furnished the grade Shorthorns, which are of the same stamp as has been used in feeding experiments at the Gwebi in former years, and which had taken prizes at fat stock shows. They were, as is usual with cattle from that cold climate and high-lying short sour veld, in rather less bloom than some of the others, but yet in fair store condition, by no means thin or backward, and the most even lot as regards weights. Their average age was about three years, four having full mouths and three 6-tooth, and their weight averaged 1,026 lbs., varying only between 1,126 lbs. and 952 lbs. They walked 60 miles, and then had a long train journey immediately prior to being stalled.

The Aberdeen Angus cattle were provided by Mr. Duncan Black, of Selby, and had had the advantage of having run for some months on the Gwebi farm. The original Angoni stock from which they were derived was brought down from Nyasaland by Messrs. Ross & Jakins about 1903. For age they were the closest matched of any lot, being all 6-tooth, or two-and-a-half to three years old, one cutting his final pair of teeth before being finished, and their weight averaged 980 lbs., fluctuating between 932 lbs. and 1,061 lbs. They were all bred by Eugenicist, a registered bull bred by Mr. James Kennedy, of Doonholm, Ayrshire, Scotland, and imported in 1918 by Sir Peter J. Mackie, who presented a number at the same time for sale on behalf of Rhodesian hospitals. They were a nice even bunch in good condition.

The Devons were selected from the herd of Mr. J. W. Palmer, Thornpark, near Salisbury, and consisted of four 8-tooth, two 6-tooth oxen—that is, from two-and-a-half to three years old—and one younger animal with four permanent teeth when chosen, but by the end of the feeding six were full mouth and one was 6-tooth. All were in good forward condition, well grown for their ages, having been reared on a well-developed fertile arable farm under good conditions, and they showed the Devon character very clearly. At the outset they were the heaviest pen, averaging 1,041 lbs. and varying from 935 lbs. to 1,139 lbs.

The Sussex grades were provided by Mr. L. Glanfield, of Ballineely, near Salisbury, and were the second cross by pedigreed imported Sussex bulls from Mashona cows. They were reared on the granite veld of the Gwebi Flats, and were perhaps the most forward lot of any, though taken straight off the veld. They were also the youngest, varying from two-and-a-quarter up to three years old, three having only four permanent teeth and the rest six at the start; whilst at the end one only had a full mouth, five had six teeth and one still only four permanent teeth. Their average weight was 989 lbs. and ran from 901 lbs. to 1,033 lbs.

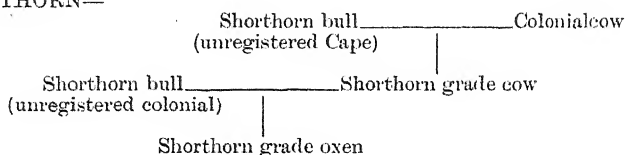
The Sussex were the only full three-quarter-bred stock used, having two crosses of pedigreed Sussex blood on pure Mashona. The Herefords had two crosses also, but the first bull used was not pure bred; on the other hand, the cows were already partly improved. The Shorthorns also had two crosses, but not by registered Shorthorn bulls, though the cows originally used were of Cape origin and somewhat

improved. The Devons had only one cross of that breed from Short-horn grade cows, and the Aberdeen Angus were also only first cross out of somewhat improved cows.

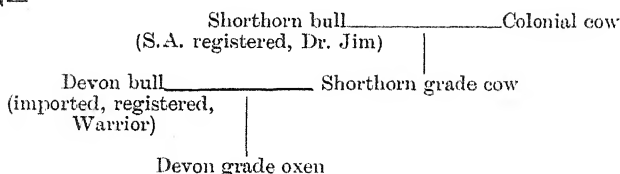
The scrubs were selected as being of similar breeding to the other lots, but not of form or type that would be chosen as feeders, the object being to ascertain how far selection by appearance is warranted, and to see if the inferior looking animals will use the food given them to the same advantage as do the more likely looking cattle; it is indeed a test of the judgment used in the original selection. Five were full mouth oxen and two had six permanent teeth. They ranged in weight from 740 lbs. to 1,021 lbs., averaging 885 lbs.

Unavoidably the cattle vary in breeding and origin. The clearest way of indicating the grade of each lot is by means of diagrams as follows:—

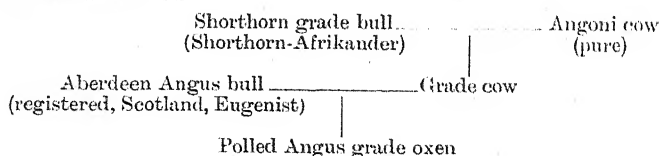
#### SHORTHORN—



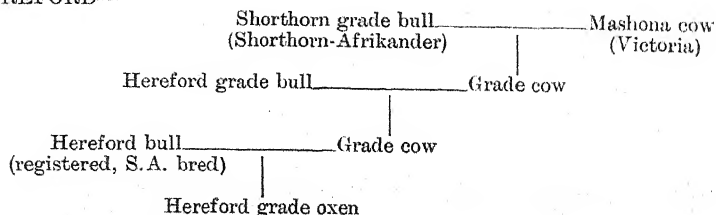
#### DEVON—

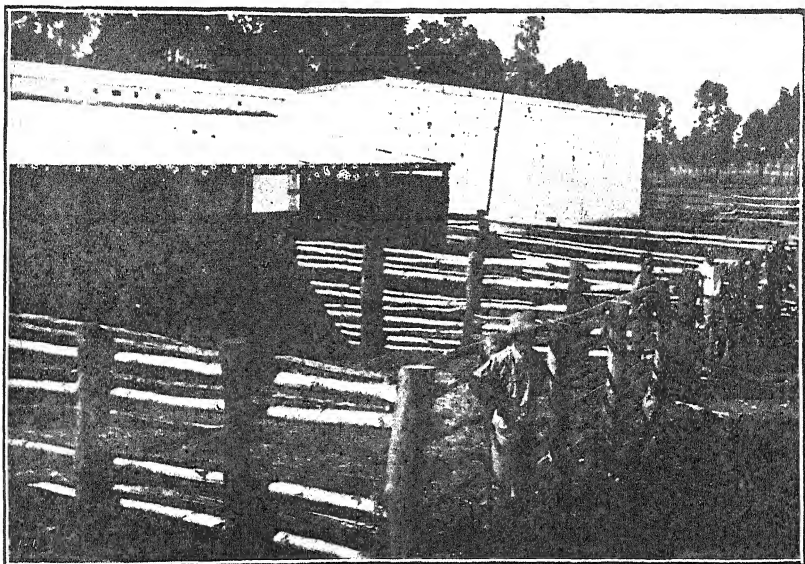


#### ABERDEEN ANGUS—

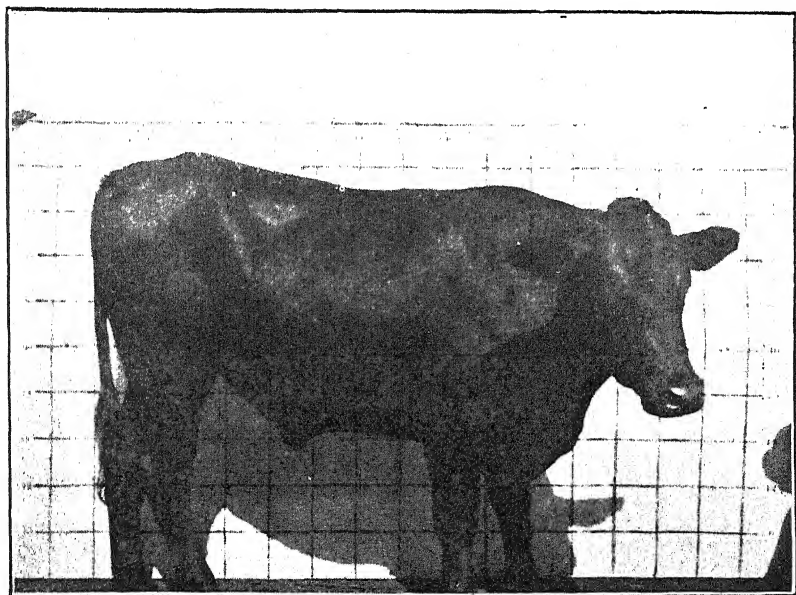


#### HEREFORD—





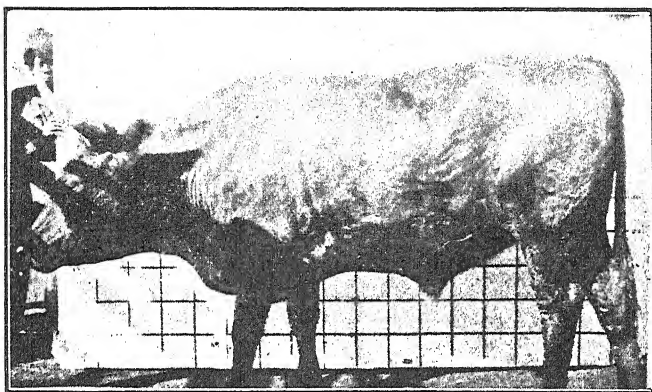
Pens used for feeding the cattle. Note spars of Mauritius hemp.



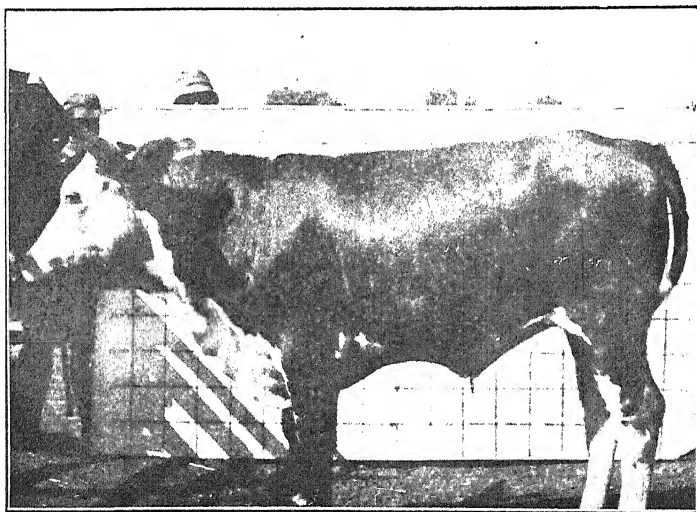
Aberdeen Angus grade No. 1.







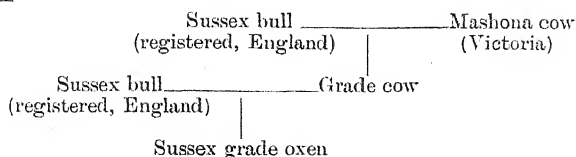
Devon grade No. 32.



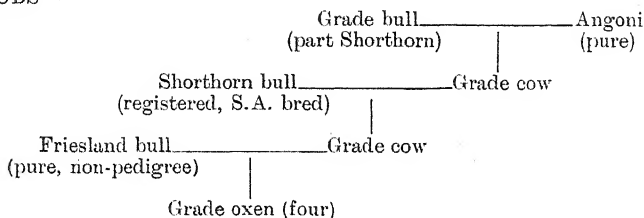
Hereford grade No. 2.



## SUSSEX—



## SCRUBS—



Also three oxen bred identically as the Shorthorn grade oxen.

The feeding was carried out on commercial lines for profit with due regard to the use of cheap food, of food produced on the farm in the ordinary course of rotation of crops, without purchase of cake or meal of any kind. Whilst quick fattening was aimed at as being economical, no attempt was made to force the animals forward regardless of expense on the lines followed in fattening for show purposes. The opportunity was taken of exhibiting the stock and selling it at the Salisbury Agricultural Show, and a number of the animals found their way to the Johannesburg market, where they were seen by the writer and by others from Rhodesia. They were certainly the fattest beasts on that day's market, although sadly reduced after their long and trying journey to the south.

The care of the cattle is most important. The health and appetite of each beast must be watched. Punctuality in feeding, watering, attending to bedding, cleaning out troughs is essential, and gentleness and orderliness in moving about amongst the cattle is important. Any excitement or disturbance is to be avoided. Plenty of bedding is wanted, added to frequently, but not removed during the whole time the cattle are in the yard. Water in the pens is an advantage, failing which the stock must be let out to water at the same hours every day and the different pens in the same succession.

The time-table followed was as under:—

*Sunrise*.—Rather more than one-third the grain ration mixed with one-third the succulent food and a little chopped hay.

8 a.m.—One-third of the hay.

10 a.m.—Replenish bedding if necessary, and give water or a little later in cold weather.

12.30 p.m.—One-third of the concentrates and succulents, followed by hay.

4.30 p.m.—Remainder of grain and silage or pumpkins and a little chopped hay.

*Sundown.*—Remainder of hay.

8.30 p.m.—Look round the cattle, and if hay finished, add more to be eaten during the night.

All changes of diet must be made gradually, and it may take several days at first to get the stock, accustomed to grazing only, to take their full ration in the pens.

The preparation of the food is important. On a clean cement floor in the feed house a day's ration at a time was mixed.

First a layer of chopped hay (velvet bean, monkey nut or manna hay) was spread out and thoroughly wetted with brine water, then the concentrates added (crushed maize, bean meal, and so on) and the whole well mixed and covered with old bags to soften and become palatable for feeding next day.

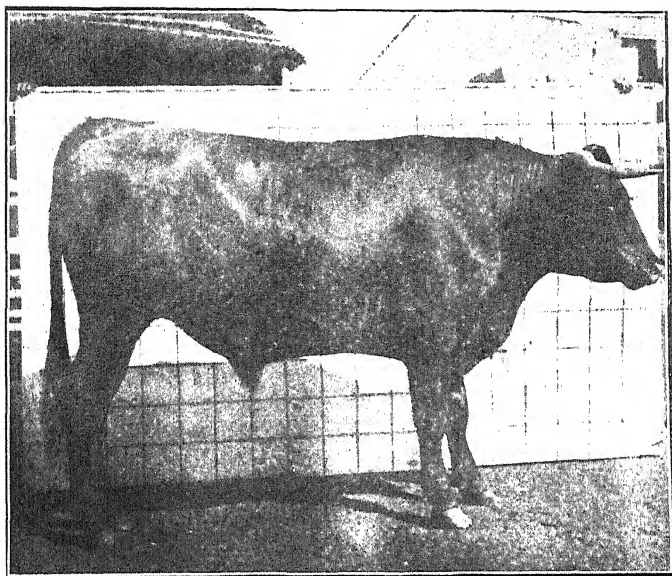
The pumpkins, majordas or mangels were shredded and added to the foodstuff before feeding, while the ensilage was fed alone after the first feed of veld hay and before the second feed of concentrates at 12.30 p.m.

Roughage is fed dry in the mangers after the mixed and softened food has been cleaned up.

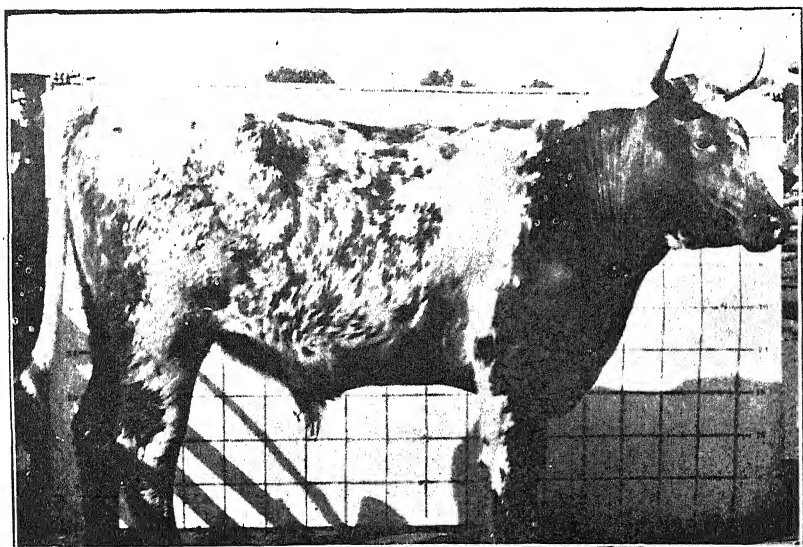
It should be recollected that the food given was precisely the same amount to each pen in proportion to the weight of the cattle. To ensure this entailed the weighing of the food and once weekly the weighing of each animal individually. Most farmers will not be in a position to do this, and must therefore be careful to make an accurate guess at the weight of each of their beasts, and the profit or loss on their feeding operations will largely depend upon their accuracy in this matter, preventing waste and ensuring the most profitable utilisation of the food. If a fair estimate of weights is made at the beginning and the stock well fed, a gradual addition of the ration on the basis of an increase of weight of two pounds per head for each day will not fall wide of the mark in practice. Changes in the nature of the diet must also be made.

The experiment was designed to start at the time the veld turned dry, after the first cold weather began, and to terminate in time to let a second lot of cattle be fed off before the natural grass comes again. The actual date of commencement was 14th May, and the stock were reasonably fat and fit for slaughter by 10th August; a very fat carcase, not being wanted by the butcher, was not aimed at. Obviously the more rapidly cattle can be fattened off the better, as less food is taken up for mere maintenance. To fatten stock slowly is not profitable, as a certain amount of food is needed daily merely to keep the animal alive, and it is only the balance over and above that which increases the weight.

These cattle were fattened off in 89 days; some were ready earlier, in particular the Herefords, and some might with advantage have



Sussex grade No. 2.



Shorthorn grade No. 20.



been kept a bit longer. The show sale was, however, a good opportunity of finding buyers as well as of exhibiting the stock to the public. In ordinary farming practice such cattle would be put on to the market from time to time as they became prime and as markets warranted.

The actual rations given were as under. During the first period a simple cheap diet was aimed at to put the stock into condition and accustom them gradually to the change from their native veld to the higher feeding of the fattening period proper. This feed consisted per 1,000 pounds live weight of 9 pounds of concentrates, 22 pounds of roughage and 18 pounds of succulents per day, made up of:—

|    |        |                                 |
|----|--------|---------------------------------|
| 7  | pounds | crushed maize.                  |
| 1  | „      | sunflower meal.                 |
| 1  | „      | ground nut meal.                |
| 14 | „      | veld hay.                       |
| 4  | „      | maize stalks.                   |
| 4  | „      | velvet beans or ground nut hay. |
| 12 | „      | silage.                         |
| 6  | „      | pumpkins.                       |

The second period of fattening entailed a more concentrated, liberal and varied diet, made up as follows:—

|    |        |                                |
|----|--------|--------------------------------|
| 8  | pounds | crushed maize.                 |
| 2  | „      | bean meal.                     |
| 2  | „      | sunflower meal.                |
| 2  | „      | ground nut meal.               |
| 10 | „      | veld hay.                      |
| 5  | „      | maize stalks.                  |
| 7  | „      | velvet bean or ground nut hay. |
| 3  | „      | mannan hay.                    |
| 16 | „      | silage.                        |
| 9  | „      | mangold or pumpkins.           |

During the last few days the amount of silage was reduced to 12 pounds and pumpkins or mangolds to 8 pounds daily.

The results are shown condensed in Table K from voluminous records kept showing the weekly weight of each animal and the amount of food of every kind given them daily, but which it would serve no good purpose to publish in detail.

What is important is the amount of food used in a given time and the increase in weight resulting.

TABLE K.

|                                                | Devon. | Sussex. | Shorthorn<br>(6 head). | Scrub. | Hereford. | Aberdeen<br>Angus. |
|------------------------------------------------|--------|---------|------------------------|--------|-----------|--------------------|
|                                                | lbs.   | lbs.    | lbs.                   | lbs.   | lbs.      | lbs.               |
| Initial weight ... ..                          | 7,285  | 6,925   | 6,260                  | 6,192  | 6,326     | 6,863              |
| Weight at end of first period<br>(49 days)     | 7,961  | 7,492   | 6,856                  | 6,812  | 7,050     | 7,404              |
| Total gain for period ... ..                   | 676    | 567     | 596                    | 620    | 724       | 541                |
| Average gain per head ... ..                   | 96.5   | 81.0    | 99.9                   | 88.0   | 103.4     | 77.3               |
| Daily gain per head ... ..                     | 1.9    | 1.6     | 2.0                    | 1.8    | 2.1       | 1.6                |
| Weight at end of second period<br>(40 days)    | 8,586  | 8,054   | 7,408                  | 7,325  | 7,528     | 8,025              |
| Total gain for period ... ..                   | 625    | 562     | 552                    | 513    | 478       | 621                |
| Average gain per head ... ..                   | 89.3   | 80.3    | 92.0                   | 73.3   | 68.3      | 88.7               |
| Daily gain per head ... ..                     | 2.2    | 2.0     | 2.3                    | 1.8    | 1.7       | 2.2                |
| Total increase in pen ... ..                   | 1,301  | 1,129   | 1,148                  | 1,133  | 1,202     | 1,162              |
| Average increase per head ... ..               | 186    | 161     | 191                    | 162    | 172       | 166                |
| Daily increase per head ... ..                 | 2.1    | 1.8     | 2.1                    | 1.8    | 1.9       | 1.9                |
| Percentage gain on basis of<br>original weight | 17.8   | 16.3    | 18.3                   | 18.3   | 19.0      | 16.9               |

The total amount of each foodstuff consumed throughout the experiment is given in Table L, which also shows that consumed by each pen. The net total increase in the weight of the forty-one cattle was 7,075 pounds, therefore it may be taken that in addition to maintaining the stock alive, every 100 pounds of increase required the following food:—

|               |                              |
|---------------|------------------------------|
| Concentrates— | 393 pounds of crushed maize. |
| 575 {         | 54 „ bean meal.              |
|               | 64 „ sunflower meal.         |
|               | 64 „ ground nut meal.        |
| Hays—         | 726 pounds of veld hay.      |
| 1,203 {       | 148 „ maize stalks.          |
|               | 232 „ velvet bean hay.       |
|               | 37 „ ground nut hay.         |
|               | 60 „ manna hay.              |
| Succulents—   | 675 pounds of silage.        |
| 1,055 {       | 213 „ mangold.               |
|               | 168 „ pumpkins.              |



TABLE L.  
TOTAL AMOUNT OF EACH FOODSTUFF CONSUMED THROUGHOUT THE EXPERIMENT, AND  
THE INCREASE PER PEN IN LIVE WEIGHT PRODUCED.

| Breed.         | Crushed<br>maize. | Bean<br>meal. | Sun-<br>flower<br>meal. | Ground-<br>nut<br>meal. | Veld<br>hay. | Maize<br>stalks. | Velvet-<br>bean<br>hay. | Ground-<br>nut<br>hay. | Manna<br>hay. | Silage. | Man-<br>golds. | Pump-<br>kins. | Weight<br>in lbs.<br>produced. |
|----------------|-------------------|---------------|-------------------------|-------------------------|--------------|------------------|-------------------------|------------------------|---------------|---------|----------------|----------------|--------------------------------|
| Devons ...     | ...               | ...           | ...                     | ...                     | 9,427        | 1,917            | 3,013½                  | 487                    | 778           | 8,762   | 2,773          | 2,151          | 1,301                          |
| Sussex ...     | ...               | ...           | ...                     | ...                     | 8,830        | 1,807            | 2,810                   | 437                    | 712           | 8,067   | 2,559          | 2,037          | 1,129                          |
| Shorthorns ... | ...               | ...           | ...                     | ...                     | 8,069        | 1,650            | 2,584                   | 416                    | 667           | 7,509   | 2,378          | 1,842          | 1,148                          |
| Scrub ...      | ...               | ...           | ...                     | ...                     | 7,932        | 1,636            | 2,544                   | 404                    | 651           | 7,397   | 2,310          | 1,851          | 1,133                          |
| Herefords ...  | ...               | ...           | ...                     | ...                     | 8,274        | 1,685            | 2,653½                  | 430                    | 684           | 7,740   | 2,437          | 1,916          | 1,202                          |
| Angus ...      | ...               | ...           | ...                     | ...                     | 8,896        | 1,821            | 2,836                   | 456                    | 724           | 8,264   | 2,604          | 2,051          | 1,162                          |
| Totals ...     | ...               | ...           | ...                     | ...                     | 51,428       | 10,516           | 16,441                  | 2,630                  | 4,216         | 47,739  | 15,061         | 11,848         | 7,075                          |

Taking each pen separately, we may note in each case the actual amount of foodstuffs used to produce the increase shown.

Analysing this table further, we can calculate that to produce 100 pounds of gain—

|                    |          |       |                             |
|--------------------|----------|-------|-----------------------------|
| The Herefords      | consumed | 2,695 | pounds of the ration given. |
| The Scrubs         | "        | 2,736 | " " "                       |
| The Shorthorns     | "        | 2,747 | " " "                       |
| The Devons         | "        | 2,820 | " " "                       |
| The Aberdeen Angus | "        | 2,985 | " " "                       |
| The Sussex         | "        | 3,028 | " " "                       |

The general results over the five pens of grade stock, including the scrubs, are instructive as showing what may be regarded as fair average results to be expected in such cases. The gain per bullock was for the first period (49 days) 90.8 pounds live weight, for the second period (40 days) 81.7 pounds, or for the whole 89 days 172.6 pounds. This may also be expressed as an average daily gain per beast for the first period of 1.85 pounds, for the second period of 2.04 pounds, and for the whole time of 1.94 pounds daily, or just under a daily average increase of two pounds.

If the results with the pen of scrubs were excluded from the above calculations, the results would have come out even better, for these animals put on the lowest daily increase of only 1.81 pounds.

It is interesting to place the individual animals in the relative order of gain in pounds for every 100 pounds of their initial weights.

TABLE N.  
PLACINGS OF INDIVIDUAL ANIMALS IN ORDER OF GAIN  
IN WEIGHT PER CENT. ON THEIR ORIGINAL WEIGHTS.

| Placings. | Percentage Gain in<br>Original Weight. | Breed.             |
|-----------|----------------------------------------|--------------------|
| 1         | 30.3                                   | Devon.             |
| 2         | 27.5                                   | Scrub (Shorthorn). |
| 3         | 27.2                                   | Scrub (Shorthorn). |
| 4         | 26.4                                   | Hereford.          |
| 5         | 24.2                                   | Sussex.            |
| 6         | 22.1                                   | Scrub (Shorthorn). |
| 7         | 21.9                                   | Shorthorn.         |
| 8         | 21.6                                   | Hereford.          |
| 9         | 21.3                                   | Hereford.          |
| 10        | 20.8                                   | Aberdeen Angus.    |
| 11        | 20.7                                   | Aberdeen Angus.    |
| 12        | 20.6                                   | Aberdeen Angus.    |
| 13        | 20.3                                   | Devon.             |
| 14        | 20.2                                   | Sussex.            |
| 15        | 19.1                                   | Aberdeen Angus.    |
| 16        | 18.8                                   | Hereford.          |
| 17        | 18.7                                   | Shorthorn.         |
| 18        | 18.6                                   | Aberdeen Angus.    |

| Placings. | Percentage Gain in<br>Original Weight. | Breed.             |
|-----------|----------------------------------------|--------------------|
| 19        | 18.5                                   | Shorthorn.         |
| 20        | 18.4                                   | Shorthorn.         |
| 21        | 18.3                                   | Hereford.          |
| 22        | 18.0                                   | Sussex.            |
| 23        | 17.9                                   | Shorthorn.         |
| 24        | 17.8                                   | Devon.             |
| 25        | 17.6                                   | Sussex.            |
| 26        | 17.5                                   | Devon.             |
| 27        | 17.1                                   | Sussex.            |
| 28        | 16.3                                   | Scrub (Friesland). |
| 29        | 15.6                                   | Hereford.          |
| 30        | 15.2                                   | Sussex.            |
| 31        | 15.1                                   | Devon.             |
| 32        | 14.8                                   | Shorthorn.         |
| 33        | 14.5                                   | Scrub (Friesland). |
| 34        | 14.1                                   | Devon.             |
| 35        | 12.74                                  | Hereford.          |
| 36        | 12.72                                  | Aberdeen Angus.    |
| 37        | 12.1                                   | Scrub (Friesland). |
| 38        | 12.0                                   | Scrub (Friesland)  |
| 39        | 11.7                                   | Sussex.            |
| 40        | 11.4                                   | Devon.             |
| 41        | 7.1                                    | Aberdeen Angus.    |

It appears from this that the tendency to put on flesh and fat was more conspicuous in individuals than in breeds.

A Devon comes out first with a gain of 30.3 per cent. and a Devon is next last.

The scrub Shorthorns take high places for gain—second, third and sixth—and the four scrub Friesland grades all come low down—twenty-eighth, thirty-third, thirty-seventh and thirty-eighth.

Shorthorns are scattered throughout the list. The Herefords appear near the top and three low down. Aberdeen Angus have a good general place, but one was at the very bottom.

Another way of looking at it is that the food consumed, detailed above, was converted into 7,075 pounds of beef, but at the same time raised the value of the original total weight (39,851 pounds) to that of prime stall-fed stock, for which the highest price is obtainable to-day.

In addition, we have 164 tons of manure, an average of 4 tons per beast.

Fluctuations in pens and individuals and regardless of breed occur from week to week and are hard to follow or explain, but when the average figures for the whole of the operations are examined we come to fairly clear conclusions, although the differences are in no case very great.

It will be seen from the accompanying tables that the daily average increase in weight per head shows the greatest gain for the Shorthorn

with 2.16 pounds per day, followed by Devon, Hereford, Angus, Sussex and scrubs in the order shown.

The prices obtained fluctuated from £12 10s. per head to £6 per head, depending upon size and the accidents of the market, regardless of breed.

The average price over all was £9 10s. 10d. per head. The owners received a uniform price of £5 10s. for the stock as received and one-quarter of the difference between that and what their cattle realised, the rest going to the Government farm in return for food and labour. It may be of interest to add that the farm received £2 11s. 9d. per head, to which may be added the value of the manure.

The owners met risk of injury or death, and one animal, the property of the Rhodes Inyanga Estate, died during the period.

**Conclusion.**—Acknowledgment is due here to those who so kindly placed cattle representing different breeds at the disposal of the Department of Agriculture for the purposes of these feeding trials. Without such help it would have been impossible to have carried out the work, as it was not feasible to buy the cattle outright and then re-sell them. The ready willingness, regardless of profit, of so many breeders to assist and to allow their stock to be used, and their spirit of co-operation, interest and friendly rivalry, are in themselves admirable, and have assisted the carrying out of the experiment as much as has their material help.

The cattle and all arrangements connected with them were under the direct charge of Mr. Donald Black, assistant at the Government farm. Mr. Black carried out the plans and instructions given in a precise, accurate and painstaking manner, without which any conclusions reached would have been valueless. Both for the care and treatment of the stock and for the preparation of complicated returns, of which only summaries are here given, Mr. Black deserves every praise and thanks.

## Hand-Rearing of Calves.

By T. HAMILTON, M.A., N.D.A., N.D.D., Dairy Expert.

The continued progress of the dairy industry in this Colony depends almost entirely on the ability of would-be dairy farmers to obtain good cows, and success or failure will depend on the kind of heifer calves raised. The size and thriftiness of the calf at birth depend very largely on the condition of the cow. There are large numbers of calves on farms in Rhodesia which, instead of showing improvement on the physical standard of their parents, show signs of degeneration, and it is too clearly apparent, if we consider our alarmingly high proportion of scrub cattle, that this degeneration is cumulative.

The care of the calf then really begins before it is born, and unless our dairy cows get sufficient and suitable food, not only whilst they are in milk, but also whilst they are in calf, both the cow and the calf must suffer. The need for the provision of succulent feed for cows in calf is not sufficiently realised, and many cows calving in October, November and December, because of the lack of this particular variety of feed (silage, sweet potatoes, majordas, pumpkins, etc.), give birth to calves which become even more miserable and undersized than their mothers.

Assuming that the calf is strong and thrifty at birth, the dairy farmer must make up his mind as to the policy which he is to adopt to get the most out of his cows. A simple arithmetical calculation will show him that if he is to go in for dairying as a business it will not pay him to hand-rear his bull calves unless they are to be kept for stud purposes.

A bull calf will easily consume on an average a gallon of fresh milk per day until he is six months old. Reckoning milk to be worth 6d. a gallon (and this is a very low figure indeed), the bull calf will have cost in milk alone £4 10s., whilst other feed consumed will, at a low estimate, be valued at £1 10s. Thus the bull calf six months old for feed alone has cost £6. If the dairy farmer feeds him, herds him and dips him for another three years, he will be lucky (at present values) to get £6 for him.

As regards the dairy heifers, the case is entirely different. No effort should be spared to keep the heifer calf healthy and thrifty and in a condition to develop that roominess and capacity which is so highly desirable a feature in a dairy cow. The dairyman should realise

that his dairy heifers are the foundation of his fortune, and a little extra trouble or expense will in the future give a rich reward.

**Treatment of a Calf at Birth.**—A heifer with her first calf, especially if she herself has been hand-reared, as a rule is quite quiet, and does not fret if her calf is taken from her. The calf should be removed, placed in a small loose box, and rubbed dry. The navel string (or umbilical cord) should be tied with a carbolised silk thread, and the calf allowed to rest for an hour or two. The mother should be milked and the calf fed on a quart of the warm colostrum three times a day for a few days, and kept quiet in a warm comfortable place.

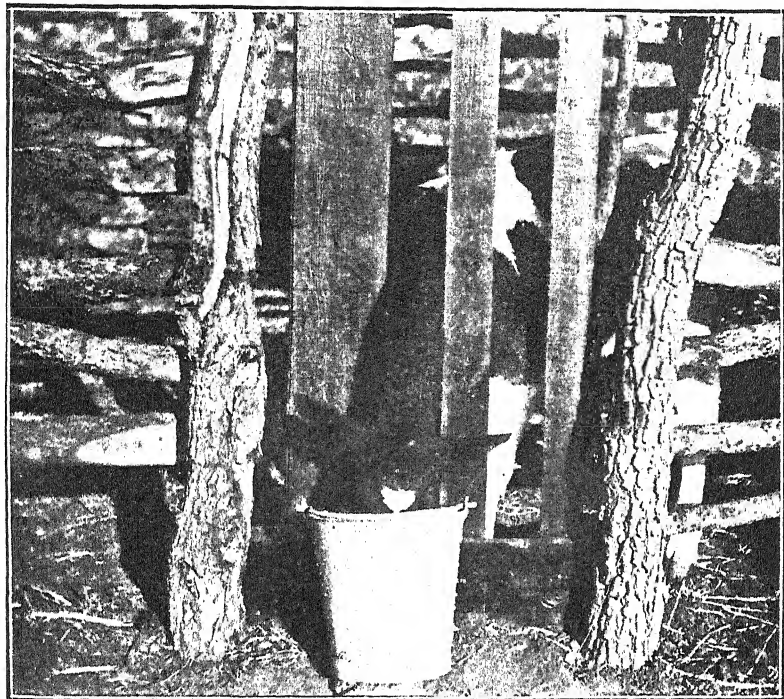
With older cows, although there are exceptions, it is sometimes difficult to get them to milk without their calf, especially if, as is the general practice, the calf is left with the mother for about 48 hours. (This practice is especially to be commended if the calf is weak and undersized.) If the cow absolutely refuses to let down her milk without the calf having a few preliminary sucks, allow the calf to be present at the milking time, but see that it does not get more than a small quantity. The cow can be milked out and the calf fed from the bucket in the ordinary way. This practice applied to the rearing of heifer calves gives fairly good results, but the question is frequently asked: "What happens if the calf is a bull and the cow refuses to milk without it?" This of course frequently happens, and has in the writer's experience been overcome by killing the calf, skinning it, and then rubbing the skin well with salt and partially drying it, stuffing it with hay, and placing it beside the cow's manger. The mother in many cases is quite pacified by having her calf's skin to lick, and goes on milking for months. The trick does not succeed in every case, but it is well worth trying.

The calf will soon learn to drink from a bucket, especially if when thoroughly hungry it is allowed to suck the feeder's fingers, which are placed in the milk.

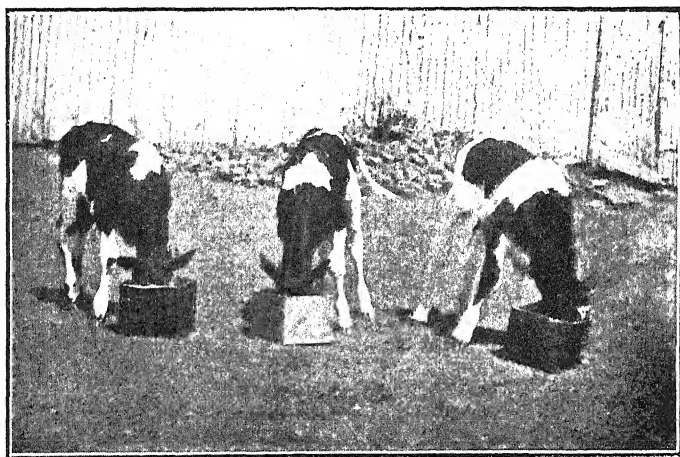
There are certain calf feeders consisting of a rubber teat and tube which obviate the necessity of teaching the calf to drink. These are quite useful, but are difficult to keep absolutely clean and sweet. At the same time the rubber teats and tube are apt to perish and to crack. Although these rubber feeders are very useful, yet in the writer's experience quite as good calves can be reared on the bucket as by feeding by means of the teat.

**Rations for Calves.**—It is essential that calves be fed regularly, and that all utensils and bedding be kept scrupulously clean. It is also necessary to feed the correct amount of milk. An over-fed calf is just as much to be pitied as one which is under-fed, as over-feeding leads to digestive troubles and scours, whilst the results of under-feeding are made manifest by the appearance of the calf, its unthriftiness and lack of size. Very young calves should be fed separately and kept in a separate calf shed or loose box until they are at least a fortnight old.

It is assumed that the average dairyman wishes to rear his calves as cheaply as is consistent with good results being obtained, and in that



Showing arrangement of stanchion. This is especially effective if large numbers of calves are to be fed.



Calves feeding from petrol tins cut in half at Mr. J. A. Baxter's plot near Salisbury.





case we shall assume that separated milk is as far as possible utilised for feed. Of course if pedigree stock is being raised it is always advisable to give unseparated fresh milk as long as it is available. Some breeders give fresh milk until the calves are a year old, but for average purposes milk is fed for about seven months. The calf is then weaned.

It is very advisable to use a milk scale to ensure that the amounts fed are correct. It should be remembered that a gallon of milk weighs 10 lbs., and that the weight of a quart is  $2\frac{1}{2}$  lbs., and that of a pint  $1\frac{1}{4}$  lbs.

In the absence of a milk scale a quart measure is indispensable.

*1st Week.*—One quart mother's milk three times a day, given warm.

*2nd Week.*—One to one-and-a-half quarts of milk, not necessarily that of the mother, given warm three times a day.

*3rd Week.*—One-and-a-half quarts new milk, plus one pint newly separated milk, given three times a day.

*4th Week.*—Discontinue the mid-day meal, because at this time, or earlier, the calves will have begun to nibble at fine well-got hay, and will also have begun to eat some concentrates, such as mealie meal, ground oats and ground nut cake. Feed, therefore, two quarts fresh milk and one quart separated milk twice a day.

*5th Week.*—Feed one quart of fresh milk and two-and-a-half quarts separated milk, supplemented with linseed or munga porridge, twice a day.

Continue for three more weeks feeding twice a day, giving increasing quantities of separated milk, until in the ninth week the calves are entirely on separated milk, supplemented with linseed porridge or a mixture of mealie meal and munga porridge well cooked. The calves should continue to get fine, well-got teff or veld hay. If lucerne hay is available, this should also be fed. Give a mid-day meal of about  $\frac{1}{2}$  lb. of a mixture of mealie meal, bran, and either crushed oats or ground nut cake. A salt lick should also be provided.

When their digestive organs are sufficiently developed at about twelve weeks on a diet similar to that outlined, a small ration of from four to five pounds of succulent feed such as mangolds or pumpkins should be given. The rations should be continued until the calves are about four months old, when the milk ration can be gradually reduced and this may be altogether omitted at an age of seven months. By this time the calves should be grazing in a well-shaded camp with a good water supply. If separated milk is available, give it to the calves until they are a year old, as it is a splendid food, and calves grow out much more quickly and attain earlier maturity if its use is continued.

The supplemental feeds recommended, with the exception of linseed, should always be finely ground and well soaked before being cooked. The following are the chief feeds recommended, their chemical analysis being given in order to show their relative food values:—

|                 | Dry matter<br>per cent. | Digestible nutrients.         |                            |                  |
|-----------------|-------------------------|-------------------------------|----------------------------|------------------|
|                 |                         | Crude<br>protein<br>per cent. | Carbohydrates<br>per cent. | Fat<br>per cent. |
| Linseed ...     | 93.3                    | 21.3                          | 21.1                       | 24.2             |
| Nyouti ...      | 91.6                    | 6.7                           | 60.5                       | 3.4              |
| Rapoko ...      | 89.4                    | 4.5                           | 63.8                       | 1.0              |
| Kaffir Corn ... | 84.8                    | 7.8                           | 57.1                       | 2.7              |
| Maize Meal ...  | 85.0                    | 5.5                           | 64.9                       | 3.5              |

It will be noticed that linseed is by far the richest in fat, and therefore is the most suitable feed that can be given to replace the cream extracted from the milk. Whilst linseed is expensive to buy, it has the merit of being fairly easily grown in Rhodesia on average soil. It is not destroyed by birds, like so many of our native grains, and gives a return of anything from two to four bags per acre. It is excellent for calves, young pigs and fowls, and should be much more extensively grown than it is. Munga, nyouti and kaffir corn fed as porridge form excellent supplemental feeds. Their deficiency in oils can in part be made up by feeding ground nuts as a part of the concentrate ration when the calves are about five weeks old. Mealie meal porridge should as far as possible be sparingly used, as, unless it is well soaked and cooked, it may cause scour.

*Preparation of Porridge.*—Two pounds of linseed should be soaked over night in 3 gallons of water. Next morning this should be boiled for about 20 minutes, and then about half-a-pound of fine mealie meal previously made into a paste should be stirred in. The addition of mealie meal is for the purpose of giving the mucilage more body and for preventing the porridge from being unduly laxative. The mixture should be allowed to cool, and will remain fresh for two or three days. One part of porridge should be mixed with four parts of separated milk and well stirred in. The sediment should not be thrown away, but should be fed to older calves or to the cows. Kaffir corn, munga or mealie meal porridge should be made in the same way, i.e., by always soaking the meal or grain over night. The amount fed depends on the age and development of the calf, but the proportion should not exceed one part of porridge to three parts of milk, unless the calves are well grown.

*Solid Feeds for Calves.*—It should be emphasised that it is absolutely necessary to keep young animals in a growing and thrifty condition. Their growing period is a comparatively short one, and the time is too short for them to make up for any severe set-back caused by disease or lack of food. A stunted animal is never profitable, and in all animal breeding early maturity, obtained by ample food and good treatment, should be aimed at. Besides the feeding of milk and its supplements in the form of porridge, it is essential to make provision for the development

of the paunch or rumen by feeding roughage or bulky feeds. When the calves are about three weeks old they will begin to nibble at fine and well-got hay. Teff hay is perhaps the most suitable for young calves, but for older animals lucerne and velvet bean hay are greatly relished, although these should be at first sparingly fed, as excessive quantities may cause scour.

For the feeding of roughage or concentrates a simple feeding trough or manger should be put up in the run. Uneaten roughage or concentrates should always be removed before next feeding time, as calves do not relish stale feed.

*The Feeding of Concentrates.*—Maize meal, oats (ground or crushed) and kaffir corn (ground) are all useful in calf rearing, but should never be fed alone, but rather mixed with a more appetising food such as bran or ground nut cake. A mixture of wheat bran and maize meal or of ground nut cake and maize meal should be fed at a rate of from a half to one pound per calf per day, according to the age or size of the calf. This can be given as soon as the calves begin to nibble at teff or lucerne hay.

The following remarks, appearing in "Calf Rearing in Natal," so aptly apply to Rhodesian conditions that they are quoted in full:—

"Farmers frequently ask for a recipe for a calf meal that they can make up themselves, and the ingredients of which may be grown on the farm. They usually grow maize only and will not persevere with other crops, valuable in themselves, which require to be grown, and therefore the chances of many farmers growing their own calf meal are somewhat remote. To begin with, oats are rarely grown by our dairy farmers. Oats can be grown well in Natal on vlei soils if it is treated as a winter crop. Soya beans have been voted a failure because they did not prove so profitable as maize. Linseed as a crop is acclaimed a nuisance; the birds take kaffir corn; wheat it is useless to grow, as the rust is so very bad. Thus the only salvation is maize meal and nothing else!

"The following is suggested as a calf meal made up from Natal-grown foodstuffs:—

|                            | Per cent. |
|----------------------------|-----------|
| Maize meal ... ..          | 40        |
| Kaffir corn meal ... ..    | 20        |
| Soya bean meal ... ..      | 15        |
| Pollards or oatmeal ... .. | 12        |
| Linseed meal ... ..        | 10        |
| Dried blood ... ..         | 2½        |
| Salt ... ..                | ½         |

"All meals should be finely ground and sifted from husks. This meal can either be mixed with separated milk or fed dry. If fed with milk, it requires to be scalded. Scalding is best done by using a wooden bucket, placing the calf meal inside and pouring on boiling water. The mixture is well stirred, and the whole covered up with a sack to keep in the heat."

*Feeding Whey to Calves.*—As the cheese-making industry is progressing rapidly, it is interesting to learn that older calves can be successfully reared on whey if this food is supplemented by the addition of a cake rich in protein, such as cocoanut or ground nut cake. Calves, however, should not get whey in place of separated milk until they are at least five weeks old. The whey should be fed fresh and warm, and is better if it is scalded and cooled down to 100 degrees. The scalding process of course sterilises the whey and destroys harmful bacteria.

**Organisation required in the Feeding of Calves.**—The hand-rearing of calves should be treated as a part of general farm routine, and special accommodation should be built for the calves. Nothing on the farm looks so unsightly and out of place as hand-reared calves or lambs hanging about the kitchen door, picking up scraps, and generally becoming a nuisance. If only two or three calves are to be reared, then the organisation required is simple. A clean, airy, well-bedded calf pen with a small run attached is all that is necessary. Suitable shade is essential, as young animals ought to spend the greater part of their early existence eating and sleeping. Calves should not be turned out to run on the veld until they are at least three months old. Up to that age they should be kept in a run or well-shaded paddock provided with a good water supply. The longer the calves are kept in during the heat of the day the better they will thrive. The two illustrations of hand-reared calves show the result of this treatment. Calves treated rationally will at ten or eleven months show greater development in every respect than those which are treated in the ordinary way, and which are allowed to walk miles almost every day of their lives from the time they are a week old.

When there are numbers of calves to be reared, say from ten upwards, some organisation and equipment is required, so that each calf should be fed individually. We publish an illustration of a calf pen from an earlier bulletin on this subject which seems to give very satisfactory results. Attached to the calf pen, however, should be a small run of about a quarter of an acre in which there is a small stack of fine hay at which the older calves can nibble, as well as a feeding trough in which the concentrates can be placed. Mr. R. C. Simmons, in the bulletin referred to, writes:—"The accompanying diagram represents a very simple arrangement of the calf shed, which minimises the trouble of feeding, eliminates error to a great extent, and is at the same time perfectly simple of construction. The dimensions given are those recommended as suitable and convenient for from 15 to 20 calves; but provided the calves are not overcrowded, and the shed is light, cool and airy, the dimensions need only be considered from the point of view of cost and convenience in building. The shed illustrated is one of the ordinary lean-to type, 20 feet long and 15 feet deep. The front is open except for a four foot rail fence. This fence is so formed that a recess (D) 6 feet square is formed in the centre, giving access to a small manger capable of holding, say, four small buckets. The manger should be about 6 inches from the ground, and have a couple of rails above it. The shed is then divided into three compartments, A, B and C, by the gates. At feeding time all the calves are driven into one compartment,

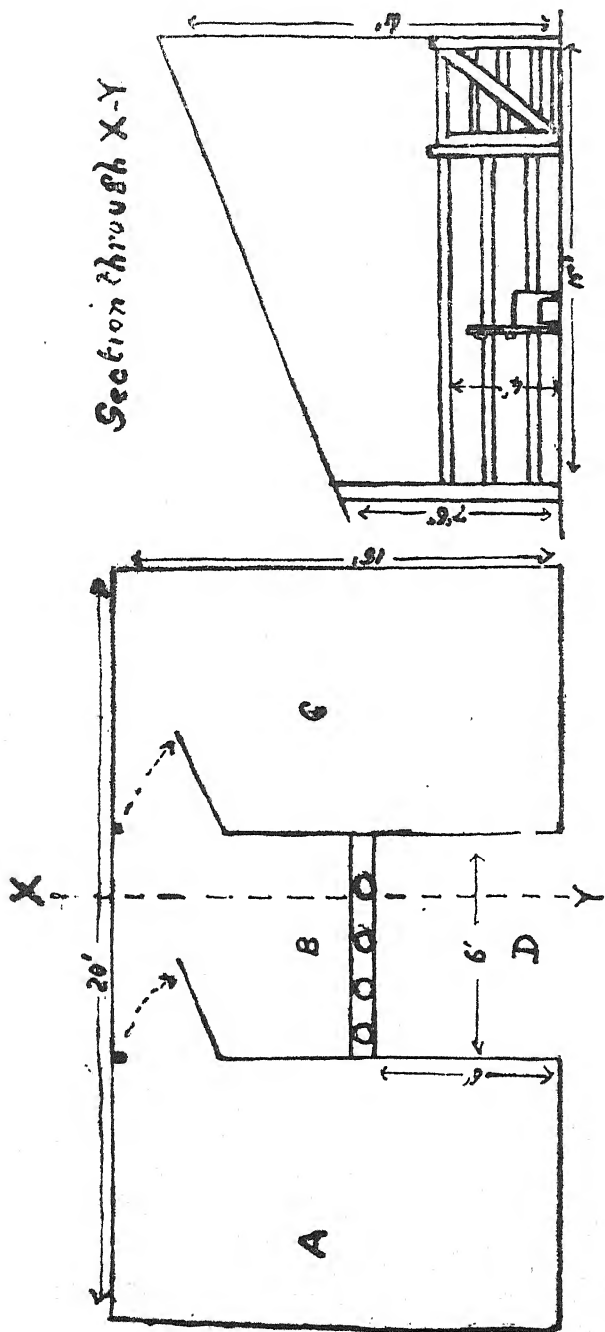


Diagram of calf house for use when hand rearing calves

say A, and the gate is closed. The milk, gruel or skim milk is brought round in large buckets and placed in the recess D. The ration for the first four calves is then ladled into the buckets in the manger, and the calves in question allowed (by a picannin at the gate) to come into the compartment B and drink. When they have finished, they are driven through a compartment C, and the next four are brought into compartment B, and so on. In practice one would bring all the calves of about one age forward first, and then those of the next age, in order to simplify dealing out the ration."

Another system which is strongly advocated is the construction of simple stanchions, such as is illustrated both in the photograph and in the diagram accompanying this article. These stanchions can be constructed from rough planks (packing cases are excellent for the purpose), and for standards bush timber can be used. When the movable rail is released the calves soon learn to put their heads through the opening. The rail is then swung up into position and fastened with a wire loop. The calf is then fast, and cannot move away without being released.

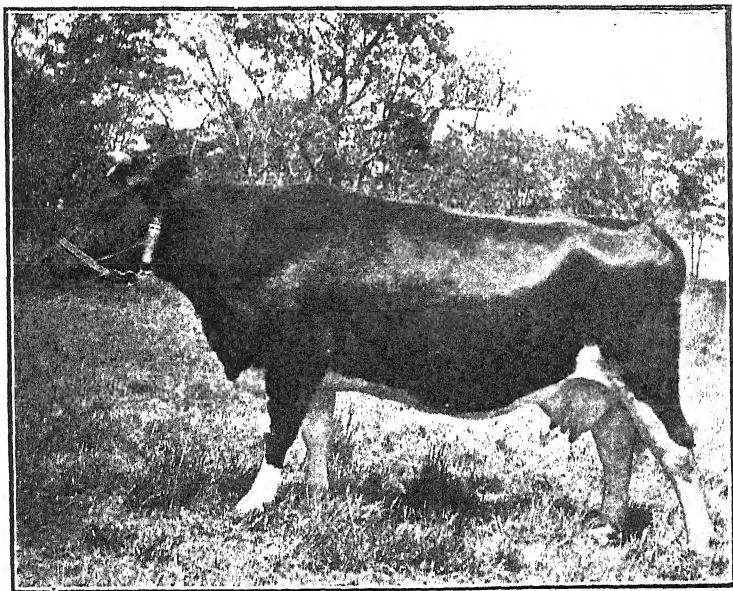
A row of stanchions can be built on each side of a central passage-way in the calf house, the bulls (in the case of pedigree animals) on one side and the heifers on the other. The attendant goes down the central passage and feeds four to six animals at a time. Petrol or paraffin tins cut in half, with the sharp edge of the tin hammered over, form excellent feeding buckets, being cheap, easily cleaned, and difficult to knock over, especially if they are placed in a frame made of two planks fixed together with cross pieces just wide enough to allow the tin to be put in position or removed for the purpose of being washed. The great advantage of the stanchion system of feeding is that calves, if allowed to stand in the stanchion for some time after being fed and thus to become dry, seem to have no inclination to suck one another, and thus the formation of hair-ball in their stomachs is to a large extent prevented.

**Sickness Affecting Calves.**—*Scour.*—This is almost entirely a preventable disease, and calves which are hand-reared do not suffer from it in any such degree as those which are suckled. To prevent scour, the following precautions should be followed:—

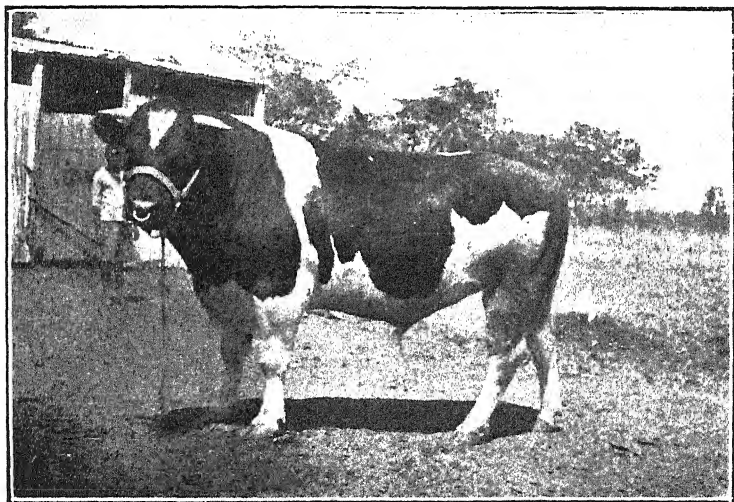
- (a) Do not over-feed.
- (b) Feed milk at the proper temperature, *i.e.*, from 95 to 100 degrees F.
- (c) Keep the feeding buckets clean. They should be frequently scoured and scalded.
- (d) Feed newly-born calves with their mothers' milk only.
- (e) Any change in the ration should be introduced gradually.
- (f) Keep the bedding clean and dry.
- (g) Keep the calves in a warm place away from draughts. Calves must always be kept dry.

*Treatment for Scours.*—

- (a) Isolate bad cases, as some forms of scour are infectious.
- (b) If symptoms appear, give the calf from two to four table-



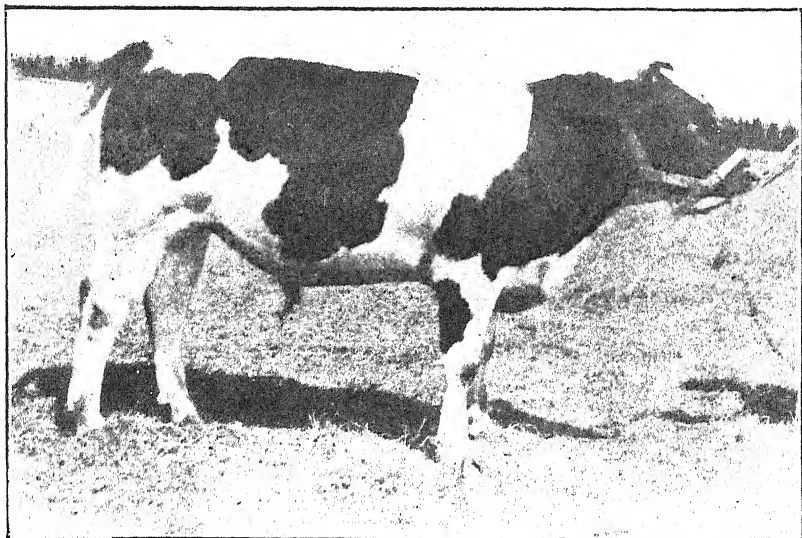
Mr. J. A. Baxter's Begonia, champion Friesland, Salisbury Show, 1923.



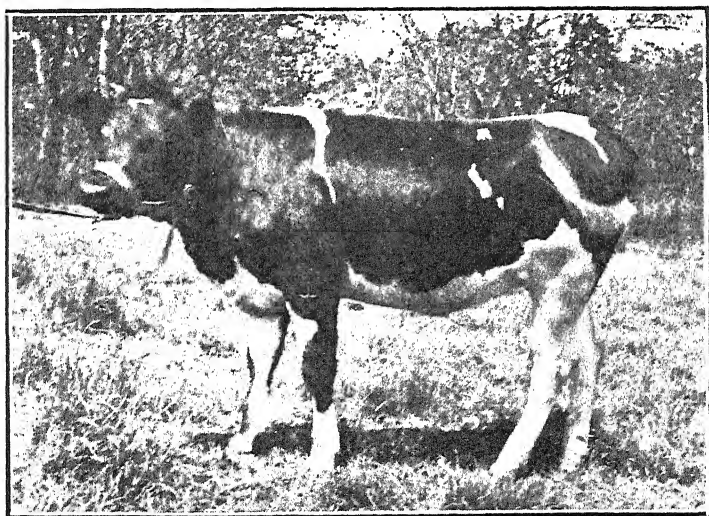
A pure-bred sire, Avoca Kingpot, property of Mr. J. A. Baxter.





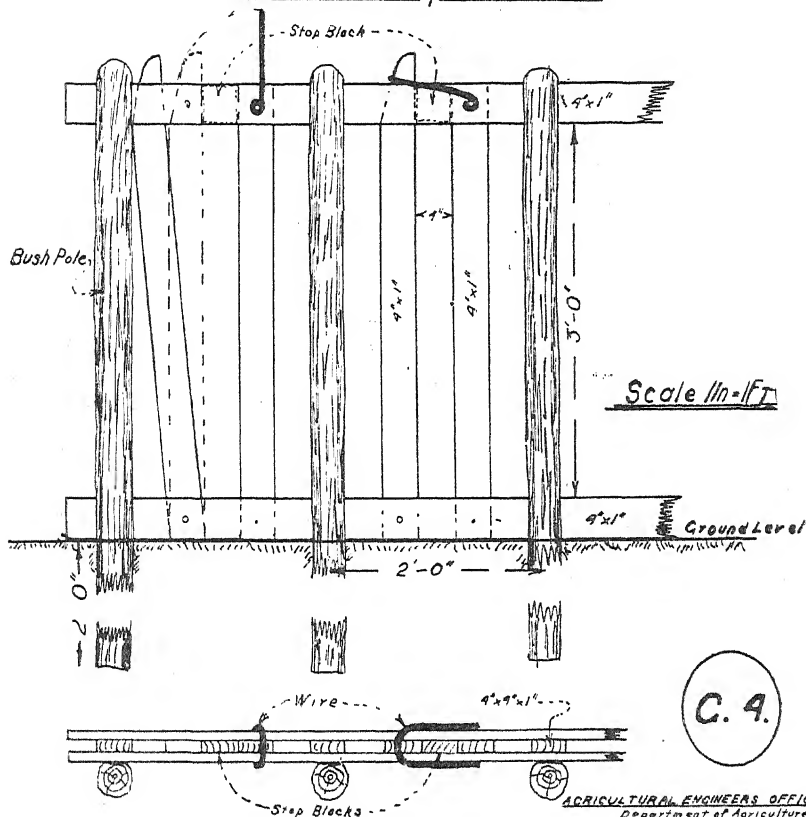


Mr. J. A. Baxter's Clacupar Prince; hand reared 11 months old calf;  
sold for 80 guineas, Salisbury Show, 1923.



Mr. J. A. Baxter's Clacupar Princess; 10 months old hand reared heifer calf.



Stanchions for Calves

C. 4.

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DEPARTMENT OF AGRICULTURE  
SALISBURY 1921

spoonfuls (one to two fluid ounces) of castor oil in a half pint of fresh warm milk.

- (c) Cut down the ration.
- (d) If the scouring continues after from four to six hours, give a full teaspoonful of a mixture of—  
one part salol; two parts sub-nitrate of bismuth; two parts bicarbonate of soda.
- (e) This dose can be repeated at intervals of from four to six hours until scouring ceases.

In any case of scour castor oil should first be given, and in the absence of the drugs named lime water or, as a homely remedy, a solution of half a square of washing blue made up in two bottles of warm water.

**Dehorning Calves.**—This should not be practised if the calf is a pedigree animal. Dehorning should be done when the calf is from three to five days old by the application of caustic potash. The horn buds exist at the bottom of the depression, one on each side of the poll. To apply the caustic, remove the hair from the skin above the horn buds, moisten the potash slightly and rub it until the skin is white. One such treatment is usually sufficient to prevent the growth of the horns. Care must be taken to hold the calf tightly, so that the caustic is not applied anywhere else except on the horns.

## SUMMARY.

### *Points to remember in hand-rearing calves.*

- (1) Use a pure-bred sire always.
- (2) Feed mother's milk only to calves under a week old.
- (3) Always feed warm milk, i.e., from 95 to 98 degrees F.
- (4) Do not over-feed.
- (5) Feed regularly.
- (6) Feed each animal individually.
- (7) Keep everything clean, especially the feeding buckets and troughs. The buckets must be frequently scalded and the feeding troughs cleared of stale food before fresh food is put in.
- (8) See that your calf shed has plenty of ventilation and is sheltered from cold winds. Lack of sunlight, fresh air and cleanliness is the chief cause of trouble.
- (9) Keep the bedding clean and dry.
- (10) Never allow the calves (up to three or four months old) to run on the veld. They should be kept in a small paddock where there is a small stack of teff or lucerne hay. Ample shade and good water are essential.
- (11) Isolate any calves which are sick and place them in a cool well-bedded loose box.
- (12) Allow calves at all times to have free access to a salt-lick.

# Forestry in Southern Rhodesia.

## THE PROPAGATION OF EUCALYPTS.

By J. S. HENKEL, Forest Officer.

**Introduction.**—In the Savannah types of forest which cover the greater part of Southern Rhodesia there is a scarcity of timber suitable for general farm use. In particular it is difficult to obtain straight spars of long length with proportionate diameters.

To supply useful poles and firewood in a short space of time—two to five years—there are no more suitable trees to cultivate than various species of the Australian genus *eucalyptus*.

The genus *eucalyptus*, comprising some 340 species of trees and shrubs, belongs to the myrtle family. The trees are evergreen, and usually of rapid growth. They generally flower at an early age. The inflorescence is either axillary or terminal. The fruits are persistent for some time and of variable size. Upon being detached from the trees the fruits soon shed the seed; the fertile seeds are usually a dark brown, and sterile seeds mostly pale brown and smaller than the fertile seeds. *Eucalypts* do not grow from cuttings, consequently seed is the only method of raising plants.

There are few localities in the Territory where one or other species of *eucalyptus* may not be grown. In Australia many of the species grow and thrive in localities which have a comparatively low rainfall, and which are subject to a long dry season, and for these reasons a number of species readily adapt themselves to the climatic conditions of Southern Rhodesia.

Because of the small size of the seed of most species of *eucalyptus*, great care is required as well as some experience in gardening to ensure success in raising plants. Even with the most experienced nurserymen, many plants are lost. For these reasons it is generally better to procure plants from nurserymen. For various reasons, however, such as distance from a railway or from established nurseries, farmers may find it impracticable to obtain seedlings or transplants from nurserymen; they have therefore either to do without the trees or endeavour to raise the plants from seed.

The purpose of this article is to give some advice as to methods in general use both by nurserymen and by farmers who have been

successful in raising plants. It must be remembered that each locality has its own special difficulties, and methods suitable for overcoming these difficulties must be devised.

Nurserymen adopt methods evolved to suit their own local conditions, and moreover usually have appliances and a trained staff that are not ordinarily available on a farm. With proper care and attention it is possible for farmers to raise all the seedlings and transplants they require. The guiding principle to be followed is to raise hardy vigorous plants with well balanced root and shoot systems, and whichever method will enable a farmer to do so, that method should be followed.

**Seed.**—As with other plants, there are amongst the eucalypts some species which have good and bad varieties. It is therefore essential that care be exercised in obtaining or collecting seed of the best varieties of each kind proposed to be planted in any given locality. The seed should be as fresh as possible.

**Nursery Site.**—If only a few plants are required for planting near homesteads, the establishment of a nursery is not necessary. The few plants required may be raised by sowing the seed in trays filled with ordinary garden soil. The resulting seedlings may be pricked out into other trays or planted direct into permanent sites. For direct planting the seed should be sparingly sown so as to yield about 80 to 100 seedlings per tray, and the seedlings hardened off as explained in a subsequent section.

Where it is intended to raise many thousands of plants it is desirable to establish a nursery. For this purpose the best site on a farm should be selected. The aspect should if possible face the south or the east. The locality should be naturally well drained, or if this is not the case, make it so by cutting drains. The soil should be a good sandy loam. The site should be near permanent water, either running or a well. If possible there should be natural protection from wind, such as trees or ridges. If this protection is absent, supply by erecting some screens of grass or bush. No large trees should shade the nursery. The site should also be protected from flood water and from trespass by cattle or other stock; and lastly, low-lying frost hollows should be avoided.

**Soil.**—The most suitable soil is a fertile, sandy or light loam. If the soil is very sandy it loses moisture rapidly. Heavy clay soils are apt to cake and fissure badly. To improve a very sandy soil add compost or humus. To improve a heavy clay soil add sand, lime or humus. The better the soil conditions the greater will be the success in raising plants.

**Preparation of Seed Beds.**—The site having been selected, it is necessary to remove any tree, shrub or grass growth and to cultivate the soil, and during the process of cultivation to remove any stones and roots of various kinds. If the site is fairly level, care must be taken not to cultivate too deeply. Usually a depth of about four to five inches will suffice. Break up all clods and generally pulverise the soil, bringing it to a fine tilth. Line out the site into beds two

to four feet wide and any convenient length. The narrower the beds the better. If the site is level, raise the beds two to four inches above the surrounding surface. If the land is on a slope, terrace along contour lines and bring the surface of the beds to a level. After laying out the beds the soil—if this is necessary—may be improved by the methods suggested in the section dealing with soil.

**Sterilising and Manuring the Soil.**—On account of fungus and insect pests it is desirable to sterilise the soil. This is best accomplished by placing on the beds some stable litter or kraal manure, and covering lightly with dry brushwood. There should be sufficient material to ensure when ignited a clean burn. A few days before it is proposed to sow the seed the brushwood should be burned. After the burning is completed, remove unburned (if any) portions of wood and large pieces of charcoal and rake the surface lightly. The edges of the beds should be dressed, and for this purpose burnt bricks are useful. Failing bricks being available, a raised rim should be made round each of the beds.

**Sowing the Seed.**—For two days before the date proposed for sowing the seed, water the beds in a thorough manner with a watering can having a fine rose. Mix the seed (without attempting to separate the fertile from the sterile seeds) with some ash and sow the seed broadcast by hand in the previously moistened soil. The object of mixing the seed with ash is to indicate the density of the sowing.

After sowing, cover lightly with clean sand and flatten the surface with a brick or a board. Water with a watering can having a fine rose. Cover the beds with a light layer of well-combed grass. If white ants are troublesome, it may be found necessary to keep the grass about one inch above the surface. This can be accomplished by putting at intervals sticks about one inch in diameter on the beds for the grass to rest upon. The object of the grass covering is to prevent the soil from caking, retard evaporation and prevent the seed from being washed away during storms or when being watered. Cheese cloth or coarsely woven hessian may be substituted for grass. The beds should be watered as necessity demands; this is largely influenced by the state of the weather. The rule to be followed is that the beds must be kept moist, not wet.

If late sowings are being made it is desirable to make provision for covering the beds with corrugated iron or planks to protect the young seedlings from heavy rains.

**Quantity of Seed to Sow.**—The quantity of seed to sow depends on the number of plants which are required for planting into permanent sites. As a rough guide it may be stated that the number of plants which on an average can be raised from one pound weight of seed is:—

Larger seeded kinds, such as *maculata citriodora*, 12,000.

Smaller seeded kinds, such as *E. saligna*, *E. botryoides*, *E. tereticornis*, *E. rostrata*, *E. sideroxylon* and *E. paniculata*, 40,000 to 50,000.

The density of the sowing depends upon whether the resulting seedlings are to be pricked out into trays or are to be retained in the nursery beds until transplanted into permanent sites. In the latter case an ounce of the smaller kind of seed to 25 square yards will be found a useful guide. If the plants are to be pricked out into trays a much heavier sowing is indicated up to four ounces to a square yard.

Sowings should always be made so as to produce more plants than will actually be required. The uncertainty of the seasons may necessitate the filling of many blanks in the planted areas. Excess plants if the season is favourable may frequently be used for planting additional areas.

**Time to Sow.**—For the raising of plants to plant out during the summer rainy season, sowings of seed should be made during the months of September, October and November. As the seasons are somewhat uncertain, it is better to make sowings at intervals during the months indicated.

**Germination.**—The period of germination is dependent on the age of the seed, species and climatic conditions. If favourable weather conditions prevail it is possible that freshly gathered seed may begin to germinate after the third day from sowing. After the third day the beds must be examined daily. When it is considered that the majority of seeds have germinated, remove about one-half of the grass covering so as to enable the young plants to get more light. Within a few days, depending on the growth made, remove all the grass and substitute shading at a height of about six to twelve inches. Only shade for a time during the hottest hours of the day. After the grass has been removed, watering must take place at more frequent intervals, but at all times care must be taken not to over-water. Any weeds which may appear should be removed.

When the young plants are about one to two inches high and have three to six leaves they will be ready for pricking out into trays or nursery lines.

**Tending of Nursery Beds.**—If the seedlings are to be transplanted direct from the nursery beds into permanent sites it is necessary to give some attention to the beds other than watering and weeding. Seedlings growing too close to one another should be thinned out to a density of about 80 to 100 plants to the square foot. When the plants have about six to ten leaflets steps should be taken to cut the roots about four to five inches below the surface, a sharp spade or draw knife being used for the purpose. The object of cutting the roots is to develop a fibrous root system above the point where the pruning took place. From time to time remove all inferior specimens, cutting them out with a sharp knife. Pulling should not be resorted to, as this method results in injury to the roots of the plants which remain.

At intervals of about a month repeat the root pruning operation. Should the summer rains be delayed and generally the conditions be unfavourable for planting out into permanent sites, steps should be taken to check the growth of the seedlings. After the seedlings have reached a height of about four inches water should be sparingly given.



The object in view is to keep the plants alive as well as to check growth as much as possible. The plants under this treatment will assume a bluish colour and lose some of their leaves. No serious injury will, however, result. Plants hardened off in this manner will more easily bear the shock of being transplanted, and when transplanted will rapidly establish themselves.

**Pricking out.**—The operation of transplanting a seedling into trays or nursery rows is called pricking out. When trays either of wood or tin are available it is a common practice to prick out seedlings about 25 to 30 in a paraffin tin cut into two portions lengthways. Seedlings pricked out into trays develop a better root system in the confined space, and fewer failures result when the transplants are set out into their permanent sites. Trays for transplants should be provided with proper drainage. The soil used may be somewhat heavier than that used in the nursery beds, so that it may be more adhesive to the roots of the transplant when being removed from the tray. The trays should be filled with moistened soil to within half an inch from the top. By means of a dibbler the seedlings should be placed in the tray at regular distances apart and planted at the same depth as they stood in the nursery beds. The soil should be well firmed round the roots. Before transplanting, trim the roots by pinching off the tap root to a length equal to the depth of the hole made by the dibbler. Care must be taken that the roots are not bent upwards.

The operation of pricking out is best performed during cloudy weather and under shade. The seedlings must be carefully lifted from the seed beds and the roots not exposed more than is necessary during the operation of transplanting.

The transplants must be well watered and kept in shade for a week or ten days either under trees or under a rough shed covered with branches. Subsequent to the period specified, the plants may be moved into full sunlight and watered as circumstances require. From time to time the trays must be moved and roots found to have grown through the drainage holes scraped off.

If trays are unobtainable, circumstances may require that the seedlings be transplanted into nursery rows one foot apart and two to three inches in the rows. This method is not recommended, for equally good results can be obtained by adopting the hardening off process specified in the section referring to the tending of seed beds.

**Diseases.**—Eucalypts in this Territory are not ordinarily subject to disease. During very wet weather, or if the seed beds have been too heavily watered, "damping off" may appear. Should the disease make its appearance, remove the affected plants and dress the spots with dry sand. Remove any covering so as to expose the plants to direct sunlight. Spraying with Bordeaux mixture helps to keep the disease in check. Where seedlings are too closely spaced they should be thinned. Water should be sparingly applied about the middle of the day so that the plants may become partially dry before night.

## Budding of Citrus Trees.

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### BUDDING AND GENERAL CARE OF YOUNG CITRUS TREES FROM SEED TO TIME OF LIFTING FROM NURSERY AND TOP-WORKING OLD TREES.

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By A. G. TURNER, Citrus Adviser.

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Frequent enquiries are made to the Department of Agriculture for information concerning the propagation of citrus fruits, and it is felt that it would be advisable to reprint an article on this subject, which has been revised by the original writer, with an addition on working over one variety of citrus trees to another variety. This is frequently done in commercial orchards for various reasons, generally because the original variety has proved unsatisfactory in the particular locality.

As a general rule, fruit growers will procure their young trees from nurserymen whose business it is to produce trees for sale in large or small quantities, and in buying from reputable nurserymen growers expect to receive good value for their money by getting reliable trees true to name and well-grown healthy stock. It is, however, advisable and even necessary to the orchardist, and particularly to the prospective grower, that he should understand this part of his business. Many people have an idea that fruit tree nursery work is as easy as rolling off a log, and all that has to be done is to put any old bud into the stock, and when the resulting growth, if it does grow, has attained a fair size, it is dug up and set out in the orchard. There are few farming operations that need such constant work and close attention to every little detail as the raising of healthy strong young orange trees. It is really a trained man's job if large quantities of trees are to be raised, but there is no reason why an amateur cannot do just as good work, hence these notes and illustrations are put together in the hope that they will serve this purpose.

It is proposed to deal only with the propagation of varieties of citrus fruit by means of seeds, as being the only satisfactory method of producing trees that will develop a strong healthy root system. All orange trees for commercial plantings are nowadays budded as a matter of course. It is possible to raise orange trees direct from the seed of a sweet orange which will produce oranges in due course of good, bad or

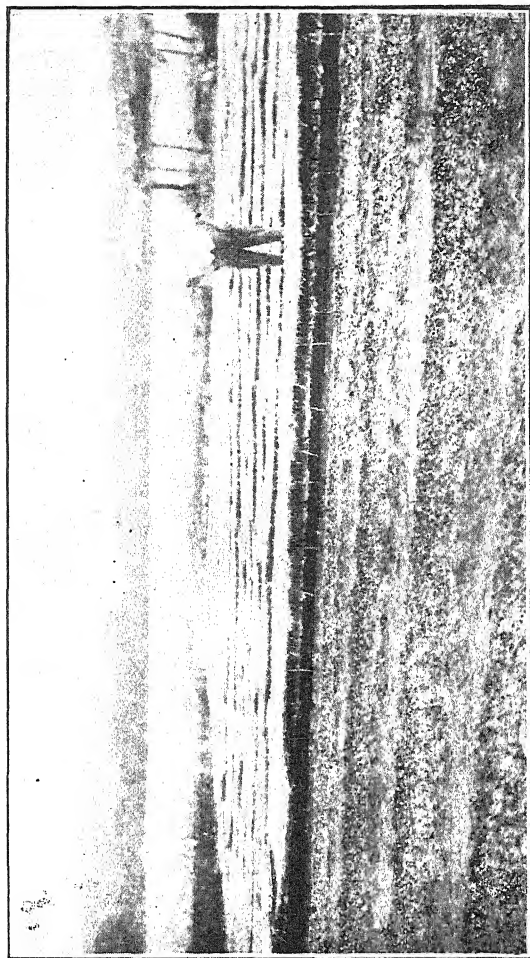


Fig. 1. Citrus seed beds; plants exposed to sun in foreground and  
beds covered with grass mats.



indifferent quality. Some seedling orange trees produce fruit of excellent quality in every way, but no dependence can be placed on the class of fruit that a seedling tree may produce as regards quality or period of ripening, which cannot be determined until each individual tree has borne fruit, hence the main reason for working over to varieties of known and desirable characteristics, such as freedom from seeds, period of ripening and other good qualities.

The seed from the Rough or Mazoe lemon is mostly used in this country, as it grows a stock that can make itself at home in almost all citrus soils, and is the most resistant of its kind against collar rot and various root troubles; sweet orange stock is used to a limited extent.

In selecting a site for a citrus nursery, it is necessary to make sure that there is an adequate water supply for irrigation purposes, freedom from damaging frosts and cold or strong winds, while the soil should be a deep, rich sandy loam, well drained, free from a clay subsoil, and having as little stone as possible.

When laying out the nursery, no precaution should be neglected to guard against the possible mixing of varieties or accidental substitution of one variety for another: it is therefore necessary to label all varieties in the field, and as a check draw up a plan showing the position of each individual lot, so that no such mistakes can occur.

The first operation is to set aside a piece of the land selected for the seed beds, which must be thoroughly and deeply worked up by digging or ploughing. No manure should be used in seed beds, as it is likely to encourage the "damp off" fungi; a light dressing of commercial fertiliser high in nitrogen will accelerate growth of the plants, but it is generally safer to use none unless the soil is exceedingly poor. A convenient width for the seed beds is about 4 feet, so that one can walk down either side and easily reach to the centre of the bed for weeding or watering operations; the length can be any distance which is convenient. Some kind of covering is necessary to protect the young plants, as in Fig. 1, which shows beds of seedlings fairly well advanced in the foreground open to the sun and others still covered. These mats or covers are made of coarse grass and reeds or any convenient light sticks, and in operation are set on forked sticks 6 or 8 inches high.

The seed is secured by cutting selected ripe fruit, squeezing out the pulp and seed and sieving, or the fruit may be decomposed in water and the seeds washed free from the pulp by use of the sieve. The fruit should be taken from vigorous trees that produce large crops of good fruit, selecting from them only plump seed; any that float must be discarded. The seed should be planted as soon as possible, so that no drying out may occur.

Seeds can be planted in July or August in the warmer parts of the country, and, given good care, seedlings are large and strong enough to set out in nursery rows the following November or December, which gives them the best part of the growing season in which to grow out, so that by the following August or September, a year from the time the seed was sown, they are fit to take a bud. In colder and less suitable situations, this plan must be modified to suit local conditions.

The seeds should be set out in rows across the bed about 8 inches apart and 3 inches in the rows, so that a hoe can be used for weeding, or be sown broadcast in the bed and thinned out as needed; the former is the better method. Care must be taken in watering that too much is not given; at the same time, the ground must not be allowed to dry out; water is best applied by water cans, pouring it on the covers above mentioned. As the plants get stronger they can gradually be exposed to the sun, until eventually no covering is required. When seedlings are to be dug from seed beds, any plants having crooked or Z-shaped roots—in fact, any poor specimens—should be discarded; also those showing any signs of gumming. In transferring them from seed beds to nursery, the roots must not be exposed to the sun for even a few seconds, as citrus roots are very susceptible to drying out, and the plants doomed to failure from the start.

Before commencing to plant out the seedlings, the nursery must be very thoroughly ploughed, harrowed and worked up into the best possible condition, so as to give the young plants every possible chance, and if necessary apply a fertiliser according to the wants of the soil; but unless the soil is very poor, this will not be required until later.

When the seedlings have attained a height of about 9 inches, they are fit to plant out in the nursery rows, which should be 4 feet apart, and the trees in the rows 15 to 18 inches. It is advisable to transplant in dull rainy weather, but if this is not possible, the land must be irrigated before planting, and again immediately after. Any good method of setting out the young plants is satisfactory, with plough, spade or dibble, provided the roots are not bent up and are well firmed in the ground.

The growth of the young trees depends a great deal on the after attention to the nursery. In order to keep them growing in healthy condition, the soil must be continually worked up, and this can best be done with a single horse cultivator down the rows and hand hoeing between the trees. Always cultivate after an irrigation and during the wet season whenever a dry spell occurs, but do not try to cultivate when the ground is in a wet boggy condition, as this will do more harm than good.

Water must be applied during the dry season as necessity arises, and in summer during any long spells of drought. The best method of irrigating a nursery is to draw small furrows on both sides of every row of trees and apply water as required. The interval between irrigation depends a great deal on local conditions of weather and soil; suffice it to say that the young trees should be kept in good growing condition, and never allowed to look backwards through want of water or cultivation, which should be recognised as the best means of raising good trees rather than by the frequent use of fertilisers.

The application of fertilisers should be undertaken with great care, so as not to unduly force the growth and yet to keep the trees in good growing order. When given during the dry season, and it is generally necessary about July or August, the fertiliser should be applied in the open furrows *after* an irrigation, and covered in immediately by the

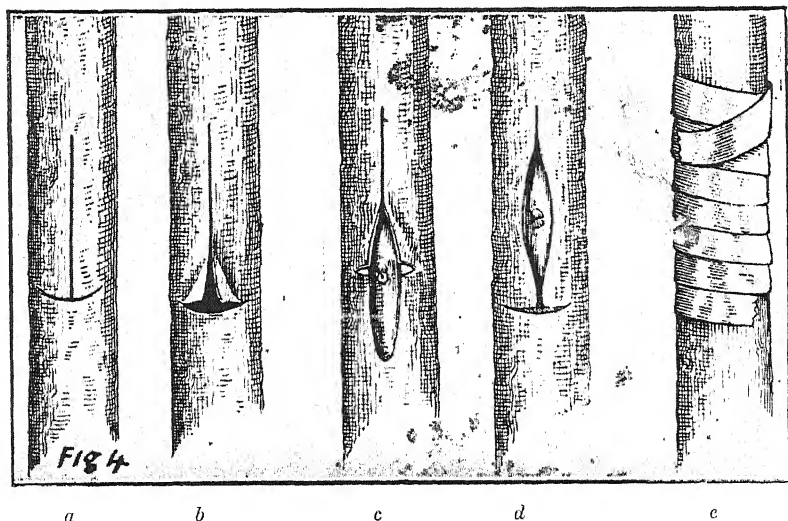
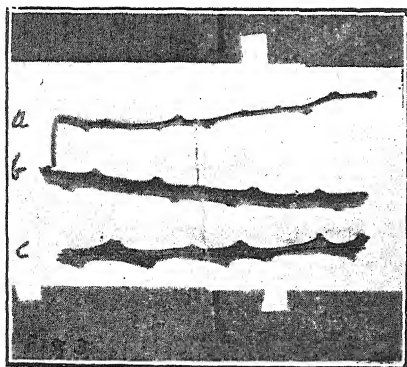


Fig. 3. Budwood.—*a*, small round, good; *b*, large round, good; *c*, angled, bad.

Fig. 4. *a*, incision on stock; *b*, incision with lower ends of bark raised for inserting the bud; *c*, bud partially inserted; *d*, bud inserted ready to wrap; *e*, bud wrapped with waxed cloth. (From Year Book, U.S. Dept. Agr., 1896.)

Fig. 5. Method of cutting bud from budstick.





cultivators. It is not good policy to actually force the young trees by means of frequent or heavy applications of fertiliser, as in the event of the trees being transplanted into a less fertile or poor soil, they are liable to stand still and even receive a check.

The operation of budding should take place when the seedlings have attained a thickness of about three-eighths of an inch 3 inches from the ground. Buds may be inserted in the stocks any time during the growing period, when the bark will slip easily; but, speaking generally, it is not advisable in Rhodesia to bud except between August and January for spring and summer working, August and September being the best months, or about the latter part of April for dormant budding. In spring and summer budding, the bud should start into growth about three weeks after being inserted, while a dormant bud should not move until the following spring. If budding takes place after about mid-January to April, the resulting growth is usually weak and sappy by the time the cold weather comes along, and seldom makes a tree worth having.

Budwood should be secured from well-matured wood of the previous season's growth, selecting only good round wood, and avoiding angled or thorny stuff; the angled wood is usually not sufficiently matured, and thorns are undesirable on citrus trees, and every effort should be made to eliminate them. Too much care cannot be taken in the selection of parent trees from which the budwood is to be taken; all diseased or unthrifty trees should be avoided, and only healthy vigorous trees used. The parent tree should, moreover, be a good specimen of the particular variety desired for propagation that has been known to produce for several years large crops of fruit typical of its variety, and it is even desirable to obtain the scions from particular branches that have borne good typical fruit, and not from suckers or water shoots. This applies especially to the Washington Navel variety of orange, of which there are a number of strains in this country—some excellent, others very indifferent and even poor. It might be well to remark here that it is somewhat generally believed that every orange bearing the navel mark is a Washington Navel. This is a most erroneous idea; there are, as a matter of fact, quite a number of navel orange varieties, but the Washington Navel is the only kind worth propagating for commercial purposes.

Immediately the budsticks are cut (Fig. 3) the leaves must be removed, leaving small stubs, which are useful for handling when inserting the bud into the stock. If the buds are intended for immediate use, the sticks should be kept in a damp cloth, but if they are to be used later, the budwood should be buried in damp sand or kept in damp moss. Avoid using the buds towards the top and base, as they are usually small and undeveloped.

When budding is to be done during August or September, in fact any time before the rains, the stocks must be well irrigated about a week previous to being budded, so as to get them in good going order, and water should be applied again as soon as the buds show signs of starting, which usually occurs from 14 to 20 days after insertion of buds.

Before commencing the operation of budding, it is necessary for the stocks to be in good condition, and to be prepared with the budwood, a good sharp thin-bladed knife, which must have a razor edge, and material for wrapping the buds after insertion. Various materials are used for this purpose, of which raffia grass is probably the most common, and is quite satisfactory, provided the ligature is properly tied. Waxed cloth or tape makes a very efficient wrapping, especially in wet weather. To make waxed cloth, procure a good strong cheap calico which will tear easily without fraying. Tear the whole piece into strips about 15 or 18 inches wide, so as to be long enough to wrap around the stocks about six times. Take equal parts of bees wax and paraffin candles, melt them together in an open vessel, dip the calico into the hot mixture, draw it out between two straight sticks, so as to drain off the superfluous wax, then hang it out to dry. When dry, make a small cut about every one-third or half an inch, so that it will tear easily; this will tear up into strips of one-third to half an inch by 15 to 18 inches. Tape can be treated in the same way.

We are now ready for the actual operation of budding, which is best done in fine weather, avoiding hot, windy or wet days. The buds should be inserted in the stock about 6 inches above the ground, and on that side which is least exposed to the extreme heat of the afternoon sun. The best way to carry the budsticks while operating is in damp sacking, to keep them from wilting; do not put them in water, as this tends to soften the bark and damage the bud.

The bark of the stock is opened by making a vertical cut about 1 to 1½ inches in length, then a horizontal cut directly across the bottom of the first cut, slightly lifting the lips at the intersection of the two cuts (Fig. 4, a and b); the bud can now be inserted, and this must be done immediately, to avoid any drying out. This is the usual method in this country, in order to prevent as far as possible the entrance of water behind the bud; but during the dry weather of August and September it is possible to reverse this, *i.e.*, make the cross incision at the top, as by this method the bud sometimes comes away quicker.

When cutting the bud, hold the budstick in the left hand with the forefinger directly underneath the bud which is to be severed (Fig. 5); insert the knife blade half an inch below the bud, cutting through the bark; pass the knife under the bud, bringing it out about half an inch above it, thus severing the bud, with a thin slice of wood adhering to it, with one clean even cut. Now insert the bud by placing it in position, and then forcing it up or down as the case may be, as shown in Fig. 4, c and d, and Fig. 7. After the bud is inserted, the whole stock is wrapped over (as shown in Figs. 4e and 8 respectively), completely covering bud and incision, with the waxed cloth or raffia sufficiently firmly so as to bring the bud and stock in close contact. If the wrapping is done too loosely, the bud may dry out; if too tightly, it may be strangled.

It is generally advisable to remove the ligatures ten to twelve days from date of budding. It is best to inspect a few, and if found not in fit condition, to leave for a few more days. If on examination the buds

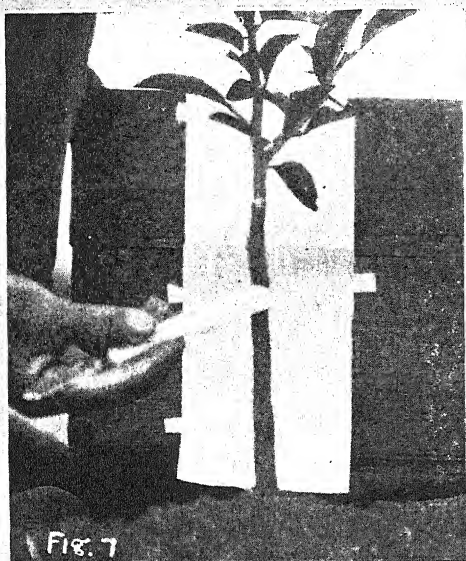


Fig. 7



Fig. 9

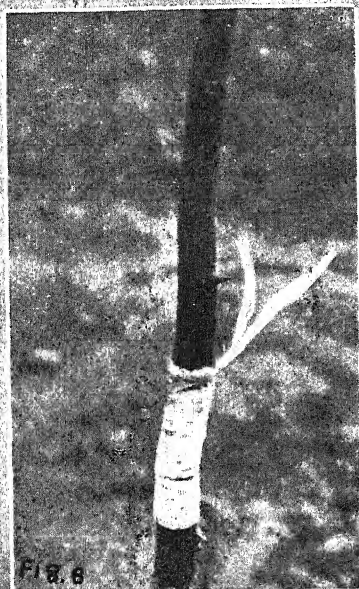


Fig. 8



Fig. 10

Fig. 7. Method of forcing bud into position.

Fig. 8. Stock with bud correctly tied with raffia.

Fig. 9. Bud growth overtopping stub of stock to which it is tied, and now ready for staking. Line indicates where stub is to be cut off.

Fig. 10. Bud growth about 18 inches in height, stock just stubbed and wound painted over. Stake in this case not close enough for proper tying.



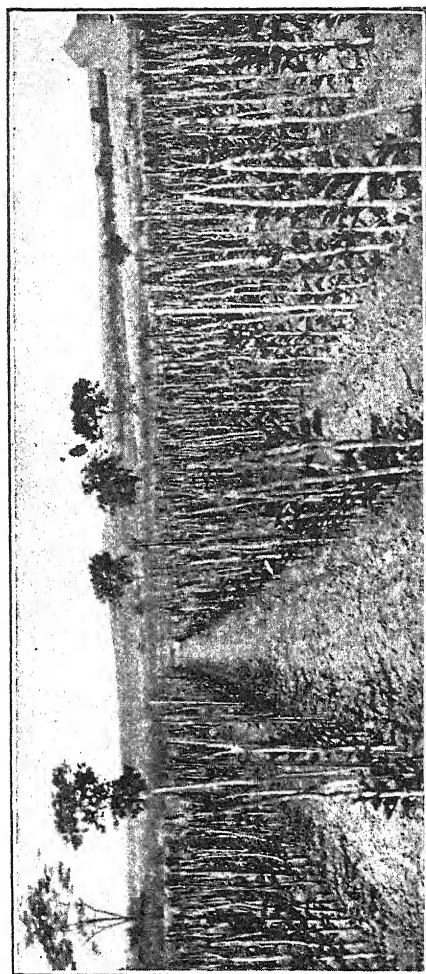


Fig. 11. Young orange trees about 1 to 2 feet in height, staked and tied.





Fig. 13. Young orange trees in nursery with heads formed, still tied to stakes and ready to lift in a few months. Budded one year previous to date of photo.





look fresh and healthy, and a satisfactory union has taken place between bud and stock, the wrapping should be removed, to allow the bud free growth. Any buds which have not "taken" will look black and have a mouldy appearance. The stocks holding these should be worked over again at the first opportunity.

When the buds show signs of growth, the stock must be cut off, leaving a "stub" of about 6 inches to which the young shoot can be tied, to protect it from damage by wind until it reaches the top of the stub (Fig. 9). This stub of 6 inches which is left of the stock affords some protection to the young shoot, and reduces the possibility of the bud being involved in any dying back which might occur. A bamboo or any other convenient stake is then driven into the ground close by the stock on the side next the scion (Fig. 13), and as the shoot grows it is tied to the stake with raffia or other soft material. This stake should stand 4 feet out of the ground (Fig. 11). When the young shoot has attained a height of about 18 inches, the stub of the stock is entirely removed with a pair of sharp shears, being very careful to give a slightly sloping cut (as shown in Fig. 10) and not horizontal. If the stock is cut off horizontally, it does not give the wound a chance to callus over properly, and trouble is almost certain to happen at some later date. The wound must be covered with paint or liquid grafting wax, in order to prevent it cracking open, and thus give entrance to moisture and fungi.

Nursery trees should be allowed to grow 3 feet 6 inches to 4 feet in one straight stem, being tied to the stake about every 6 inches to ensure a straight trunk, side branches and suckers being frequently suppressed; they should then be headed back to about 30 inches. The head is then formed by allowing three to six growths to push out according to position, so as to give an evenly balanced top, which should be distributed over the upper 8 inches to 12 inches of the stem (Fig. 13), thus forming a strong framework on which the future tree can be built. If the young trees were pinched off as soon as they attained the height of the desired head, the growth is not as strong as by following the practice given above.

If the work is faithfully carried out from the time the seed is put in the ground, the young tree is ready to lift for transplanting in orchard form in two-and-a-quarter to two-and-a-half years from the time the seed is sown.

At the time of lifting the young tree from the nursery, the top should be well cut back to compensate for the loss of roots, and when set out in the orchard it should be trimmed to shape, so as to encourage growths in the directions required to give an evenly balanced head. The greatest care must be taken that the roots are not exposed to the sun for even a few seconds; wet sacking should be provided, under which they can be placed immediately they are taken out of the ground.

**Top-Working of Old Trees.**—It becomes necessary at times to work over old citrus trees from one variety to another. It may happen that a particular variety is planted and has grown perfectly well, but perhaps does not produce good fruit of this kind in the particular locality, or the variety has gone out of commercial use. Anyway, for one reason or another, it is deemed advisable to alter the variety. The

trees will be well established, and will therefore make new heads and produce crops of fruit earlier than if the old trees were grubbed out and replaced by young trees, and it is also less expensive than replanting.

This operation can be done in two ways, either (1) by completely beheading the tree and later inserting the buds of the variety it is desired to propagate into the resulting new growths, or (2) by inserting the buds of the variety it is desired to propagate into the old wood of the existing limbs in suitable places prior to removal of the top, and finally cutting away everything except the growth from these buds.

The first method mentioned has given more satisfactory results in this country than the second, and is therefore recommended in preference.

There is no particular difficulty in this operation, which can be undertaken by anyone who has a useful knowledge of orchard practice.

The procedure to follow is to behead the trees above the existing heads: it is not advisable to cut off below the head, as there is then a larger surface which does not callus over so completely as with the smaller cuts through the limbs. If the existing heads are unusually high, some growths can be allowed to develop on the stem into which buds can be inserted, thus bringing down the head of the future tree; all of which points count in the future health of the tree.

The best time in this country to behead citrus trees for top-working is July, a few weeks prior to the first flush of growth, when the entire tops of the trees must be cut off, leaving only three or four stubs, about 9 to 12 inches long, from the main fork, as shown in Fig. B.

When this has been done, paint over the exposed cuts, large and small, or apply grafting wax, and then whitewash the entire tree, in order to prevent sunburn. Make sure the cuts are well covered with paint or wax, as if the stubs begin to check up they are liable to die back. The trees must be regularly irrigated until the rains arrive, in order to keep them in good growing condition.

Out of each stub and the main stem a mass of growth will appear. Allow all these sprouts to grow until about 6 to 9 inches in length, then eliminate all except about four of the strongest well-placed growths on each stub, and possibly one or two below the head on trees that were originally extra high headed, and suppress any other growths that may appear. In selecting the growths in which it is intended to insert the buds, it is advisable to leave one or two as near the cut as possible, as this assists in callusing over the wound.

About October to December of the same year, dependent on the attention given, climatic and other conditions, these growths (*vide* Fig. C) should be grown sufficiently large for budding, when the principal and future treatment is the same as described for nursery work. It is desirable to set a bud, and sometimes two buds, into each of these growths and eventually leave two of the best placed on each stub, and one or more below the old head as occasion may require, in order to make a well-balanced tree. In some cases it may be advisable entirely to eliminate one or more of the old stubs with its resulting growths.

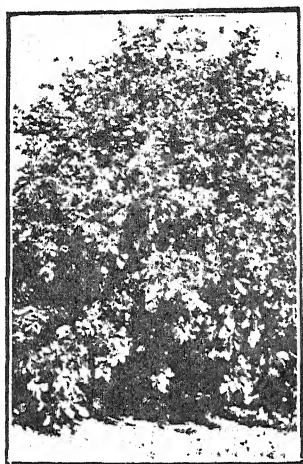


Fig. A. A typical tree of a lot beheaded.

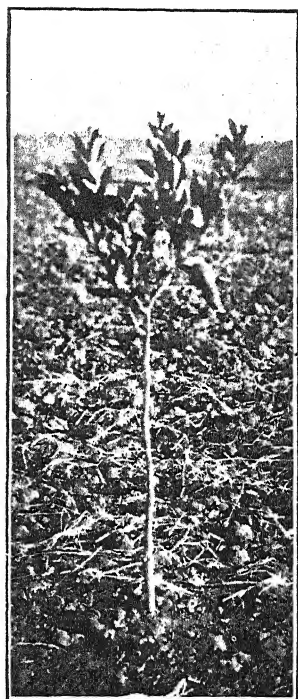
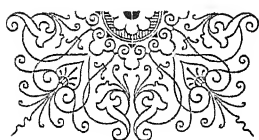


Fig. 15. A typical individual tree.





Fig. B. An orange tree beheaded for top working.



Fig. D. A top worked orange tree. Growth during first season from budding.



Fig. E. A top worked orange tree. Growth about one year from budding.

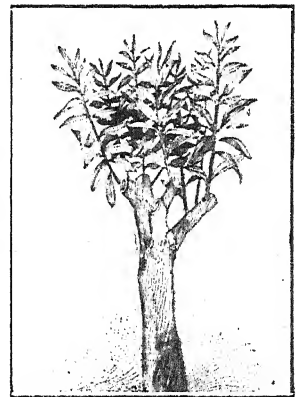


Fig. C. A tree three months after beheading, showing growth of shoots, in the base of which buds are to be inserted.



As the buds grow they require constant watching, and the main growths should be pinched back when they have attained about 2 feet in length. This process tends to strengthen the growth and to some extent affords protection against high winds. In order to afford the fullest possible protection from damage by wind, animals or other causes, it is advisable to set long sticks firmly in the ground in such positions that the growths from the buds can be tied to them until such time as the new growths are thoroughly united to the old stock.

Fig. D shows an orange tree at the end of the first growing season in April, the tree having been cut down the previous July and buds inserted in November.

Fig. E shows a tree re-worked at the same time as Fig. D, but six months later.

The practice of budding into the old wood (2) is carried out on somewhat similar lines to that just described above in (1), the best time of year being the spring. Considerable labour is entailed and trouble in keeping suckers and water sprouts suppressed, which are always liable to grow throughout the future life of the tree on account of the much greater area of old growth that is left than is the case in (1).

In some old trees the bark is so thick that it is difficult to insert buds at all; however, this may be overcome by scraping the bark down thin around the spot where the bud is to be inserted. The branches should be prepared beforehand by trimming up and the buds inserted in the selected branches before beheading the tree. As soon as the buds have "taken," the tops of the branches should be removed and the entire tree whitewashed, in order to prevent sunburn. One or two branches are generally left for the purpose of shading the buds and drawing the sap. These must be cut out later when the new growths from the buds have attained a height of about 2 feet.

## Ducks on the Farm.

By H. G. WHEELDON, Assistant Poultry Expert.

Within recent years the raising of ducks in Rhodesia has received more attention, and it is now a profitable source of income to many breeders. This branch of poultry keeping is capable of great development and is a very remunerative business when carried out under the modern system of hatching and raising, and provided the work is undertaken in close proximity to the markets. When it is considered that a young duck carrying from 4 lbs. to 5 lbs. of saleable weight that will fetch from 1s. to 1s. 3d. per lb. live weight can be disposed of at 10 weeks old from the date of hatching it will be realised there is money in the business.

Ducks are one of the quickest maturing birds we have. They are easy to rear, and for young fat ducks about ten weeks old there is a good demand. At this age the flesh is tender and juicy and realises a comparatively high price. Up to this period also the flesh is more economically produced, and all ducks intended for table purposes should be sold at this age. Ducks are considered to be the hardiest of the inmates of the poultry yard, since the loss of ducklings need not be more than from 2 to 5 per cent. They are very seldom subject to disease or insect vermin, they are easy to control in runs, and the equipment required is neither extensive nor expensive. It will therefore be realised that there is money in raising ducks for anyone who will make an intelligent effort to secure it.

The farmer can feed ducks at a minimum cost, as one-third of the bulk of food for breeding ducks may largely consist of waste vegetable leaves or other green vegetation which the farmer may sort out from his vegetable garden and on which he places but little value. If the farmer is a dairyman, the skim-milk fed to stock ducks furnishes the best of nourishment at little cost, and if fed to growing ducklings will produce twice or three times the value it would if fed to many other classes of farm stock. There is always a demand for well fattened ducks, and a simple advertisement that they can be secured is all that is necessary for their disposal. Duck eggs are not in as great demand, except for cooking purposes, as they should be, considering that their food value is as great as hens' eggs. They are a trifle richer and perhaps slightly less digestible, but still, they should be in greater demand than they are.

**Breeds.**—There are quite a number of wild and domesticated breeds of ducks. The best known of the latter are the Aylesbury, Pekin,



Rouen, Indian Runner and Muscovy. Another breed which is gaining in popularity is the Khaki-Campbell. Other varieties are the Buff and Blue Orpington, Cayuga and the Crested Duck.

*The Aylesbury* is a fine white bird, with a long, broad, deep body carried horizontally—the keel practically parallel with the ground—with light-coloured bill and bright orange shanks and feet. The flesh is solid and white. The Aylesbury is essentially a table duck and matures very quickly, and the ducklings if properly fed and cared for will weigh 5 lbs. to 6 lbs. in ten weeks. This breed is the favourite in England. Standard weights: drake, 10 lbs.; duck, 9 lbs.

*The Pekin*.—This is the favourite American breed both for utility and exhibition purposes. It is not quite so long in body as the Aylesbury, and the carriage is more upright. It is white in plumage, tinged yellow or cream. The flesh is yellowish with a delicate flavour. The bill, shanks and feet are bright orange in colour. Eyes dark lead-blue. Standard weights: drake, 9 lbs.; duck, 8 lbs. The Pekin is considered to be the best general-purpose breed of duck. It matures fairly quickly, but is more active and a better layer than the Aylesbury, and it is a non-sitter as a rule.

*The Rouen* is essentially an exhibition breed, and is the most beautiful breed of all domesticated ducks. The type, size and carriage are not unlike that of the Aylesbury. They are generally slightly heavier and more ungainly in movement than the two previous breeds, and the skin is slightly dark in colour. In quality and colour of plumage it resembles the wild duck or mallard, except that this has been bred darker and richer. The eggs are somewhat small as a rule, and some strains are good layers. Standard weights: drake, 10 lbs.; duck, 9 lbs.

*The Indian Runner* is essentially kept for egg production, being a remarkably prolific layer of large, light-coloured eggs of good shape. The two best known varieties are the white and the fawn and white. The body is long, narrow and racy-looking, the carriage being very erect, somewhat after the form of a penguin. Indian Runners are hardy and the best foragers. They do well without swimming water and are easy to rear. The standard weight drake is 5½ lbs., and the duck 4 lbs. The weight of either sex should not exceed 5½ lbs. nor be less than 3½ lbs.

*The Muscovy*.—There are many of these in South Africa. They differ greatly from ordinary ducks in type and about the head. The colours vary from white with a black crest to black and black and white. The face is free from feathers and fleshy and bright red. The drake weighs about 10 lbs. and the flesh is medium dark in colour, but varies with the food they eat. They do not make good table ducks, and from a grower's point of view they are rather slow maturing; and the size of the drake as compared with the duck varies greatly, which is a disadvantage for marketing. They are good sitters and fairly prolific. One point about this variety is the fact that their eggs take five weeks to hatch as compared with four weeks in other varieties. Muscovies are also more difficult to control in runs.

*The Campbell Duck* is somewhat like the Rouen in appearance, but much lighter, with a plain head of a greyish-brown shade; the drakes have grey backs and a pale claret breast, and the legs are yellow. The original strain was descended from one duck which exhibited most remarkable laying powers, the object being to produce excellence in laying, with fair table qualities and quick maturity. They are not very large, stock birds weighing  $4\frac{1}{2}$  lbs. to 5 lbs., and in flavour they are said to considerably resemble the wild mallard, which was used in crossing as one of the foundations of the strain. The Khaki-Campbell is a sub-variety of this, and of more recent production. The Indian Runner has been used in crossing to produce this variety, and as the result the Khaki-Campbell duck is of extremely active habits, doing best on free range and showing very little desire for swimming. At whatever time of the year they are hatched, they are said to commence laying at six months old and even sooner, so that by hatching three lots, very early, medium and late eggs may be obtained all the year round.

In South Africa there are many crosses of the Aylesbury and Pekin, and both being, as they are to the casual observer, white, they are therefore much alike. Their distinguishing characteristics are, however, well marked, as will be seen from the following:—

|                   | <i>The Aylesbury.</i> |     |                                                |     | <i>The Pekin.</i>                                                  |  |  |  |
|-------------------|-----------------------|-----|------------------------------------------------|-----|--------------------------------------------------------------------|--|--|--|
| Body              | ...                   | ... | Deep and long                                  | ... | Short and deep                                                     |  |  |  |
| Colour of plumage |                       |     | Pure white down to the skin                    |     | White, with canary-yellow tinge, especially under the wings        |  |  |  |
| Head              | ...                   | ... | Rather flat, and longer than that of the Pekin |     | Deep, rounded and short from front to back, and prominent forehead |  |  |  |
| Beak              | ...                   | ... | Pinkish or flesh colour                        |     | Orange or yellow                                                   |  |  |  |
| Eyes              | ...                   | ... | Dark                                           | ... | Dark lead-blue                                                     |  |  |  |
| Carriage          | ...                   | ... | Horizontal                                     | ... | Upright                                                            |  |  |  |

It will thus be seen that there are distinct differences in the two breeds, and duck raisers should note this when buying or selling stock.

**Housing.**—The housing of ducks is not a difficult matter and does not require much attention. An open wire fronted low-built shed on sloping ground will prove satisfactory; 5 ft. high in front and 4 ft. at the back, 15 ft. long and 10 ft. deep will accommodate 50 ducks. As ducks are very susceptible to rheumatism and cramp, it is most essential that the roof of the house be water-tight and free from leakages. The floor inside should be well elevated above the surrounding ground, and this should be hard, preferably made of cement, sloping gradually from back to front of the house, well littered and kept dry and clean by frequently renewing the litter. Wooden and earth floors are the least desirable, as they quickly become tainted and are difficult to keep dry and clean. The sides of the house need not necessarily extend to the roof; it is desirable to leave an opening three or four inches above the walls and below the roof for ventilation, as ducks like plenty of ventilation. Nest boxes are not required, as a duck often prefers to make its own nest on the floor. A few bricks

may be provided, however, on the floor, if desired, for this purpose. A wire netting enclosure or run 3 ft. high should be provided, as it is advisable to keep the breeding and laying ducks from swimming water until 10 a.m. or 11 a.m. during the laying season, supplying them with drinking water only for this period, otherwise they are very liable to drop their eggs in the water, which generally means a loss. An enclosure 3 ft. high is ample to confine ducks. If possible, a running stream or water furrow through the yard would be a great convenience and save a lot of trouble as far as the water supply is concerned.

**Selecting and Care of Breeders.**—Vigour, quality and early maturity are the primary considerations in selecting breeding stock. Large birds are desirable, with good shape and a deep body. Medium size active birds are more satisfactory than larger ones, which may be coarse, and consequently take longer to put on flesh and fatten. The ducks which are to be kept as future breeders should be selected when six weeks old. At this age a careful selection should be made by picking out the more advanced and promising ducklings, and these should be allowed free range and plenty of exercise to build up birds with vigour and with well-developed frames. Early hatched, fully developed young birds generally make the best breeders; preferably a vigorous drake twelve months old mated to two-year-old ducks.

The question of how many ducks to mate safely to a drake is governed to some extent by the water supply. Breeding ducks must have water to swim in, but not necessarily deep water, in order to make sure of getting fertile eggs, although "dry" rearing in the United States has produced strains that breed satisfactorily even if not allowed to swim, and some dry-reared ducks are found fertile in England. It is better, however, to supply the heavy breeds of ducks with swimming water. If a running stream or water furrow through the yard is not available, a small pond 6 ft. square and 1 ft. deep in each pen will suffice for a breeding pen of six birds. The sides and bottom of the pond should be lined with cement and the water renewed at least once a week, according to the season of the year. A breeding pen may consist of three, four or five ducks and one drake. In the event of there being an ample water supply and unlimited space, the breeding stock may be mated in the proportion of three drakes to twelve ducks at the commencement of the season, and as the weather becomes warmer the number of ducks may be increased to 18 or 20 with advantage. This system of mating applies more particularly to the duck farmer who raises ducklings for market. It is important that the male and females should not be too closely related if hardy, vigorous ducklings are required. Ducks may be bred from until they are three or four years old, and the drakes to be mated to ducks of this age should be preferably two years old.

The breeding stock should be mated up early in May. Before setting large numbers of eggs or sending out to customers, it is advisable to ascertain the fertility of the eggs. As a rule, the first eggs laid by young birds are apt to be unfertile, though if the birds are well cared for and fed, the fertility quickly improves. It is customary, therefore, to test the eggs in an incubator or under a hen until good

fertility can be relied upon. Young ducks generally lay the earliest eggs in the season, and the older ones quickly come on as the spring advances and as the weather becomes warmer.

**Feeding.**—With reasonable care the feeding of stock ducks is not a difficult problem, provided the ducks are allowed ample exercise, either by foraging about or swimming, which prevents them from becoming too fat. Ducks are somewhat large eaters and readily put on fat, so that with swimming exercise and at the same time avoiding fattening foods to a reasonable extent the risk of an over fatty condition of the birds may be reduced to a minimum. With good range, stock ducks do not require much feeding, as they would pick up a great deal in streams of water in the form of worms, grubs and weeds; in such circumstances a little mash in the morning and grain in the evening will suffice. It should be pointed out that ducks are gross feeders of vegetable and animal foods, even more so than fowls, and for best results these must at all times be supplied to them when kept in confinement or where they do not have access to streams of water. A deficiency of either of the above will put ducks off the lay. Another important item in the feeding of ducks is a liberal supply of oyster shell during the laying season. In this respect ducks might be termed artificial birds, for if oyster shell is withheld egg production may cease entirely, and young ducks six months old will very often delay in commencing to lay if not supplied with oyster shell or well slaked lime. Ducks must also be supplied with grit. If at any time it is necessary to change the diet, this should be done gradually, as any sudden change of food may affect the fertility of the eggs, or will interfere with the egg production. The mash should consist of—

- 2 parts wheaten bran;
- 1 part mealie meal;
- 1 part green food (chopped up);
- 5 per cent. to 10 per cent. animal food.

Moist mash should be given to ducks in shallow trays or troughs.

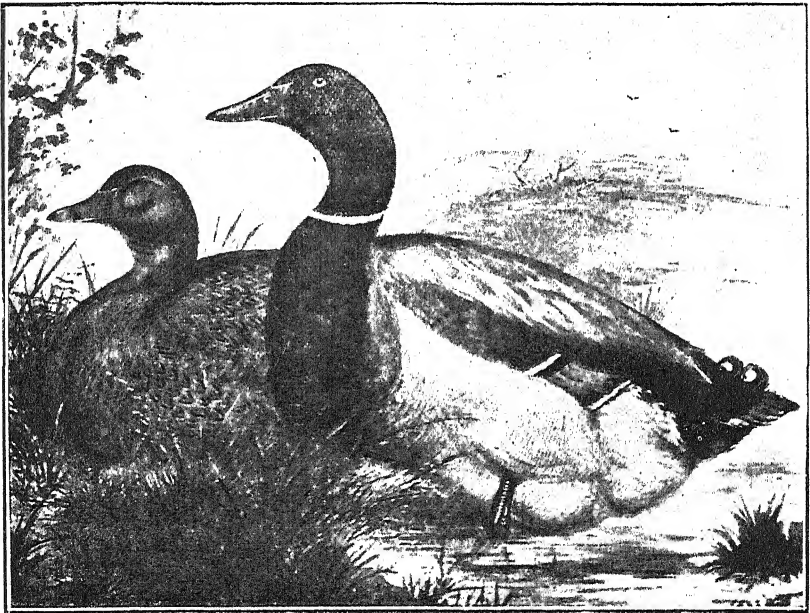
The best grain foods for stock ducks are wheat and oats; crushed mealies will prove satisfactory, however, provided the ducks are allowed plenty of exercise. The grain food should be thrown into a pond or shallow vessel of water. This method of feeding the grain is more natural, and the ducks are able to pick it up and enjoy it better. Oyster shell and grit may be given in the same way, which if thrown into a pond will keep the ducks occupied in searching for it and at the same time it will induce exercise.

**Incubation.**—If duck eggs are slightly more difficult to incubate than hen eggs, the duck raiser has one consolation, in that ducklings are more easy to rear than chickens. Duck eggs intended for hatching should be carefully stored to prevent evaporation of the contents, and the fresher they are when set, the better. They may be set either under ducks, hens or in an incubator. Ducks, however, usually make indifferent sitters and worse mothers, and they are more difficult to control and handle than hens.

The conditions for the successful hatching of duck eggs are similar



Aylesbury duck and drake, first and special prize winners, Salisbury Show, 1923. Bred under Rhodesian conditions by Mr. T. A. Stokes, The Poultry Farm, Salisbury.



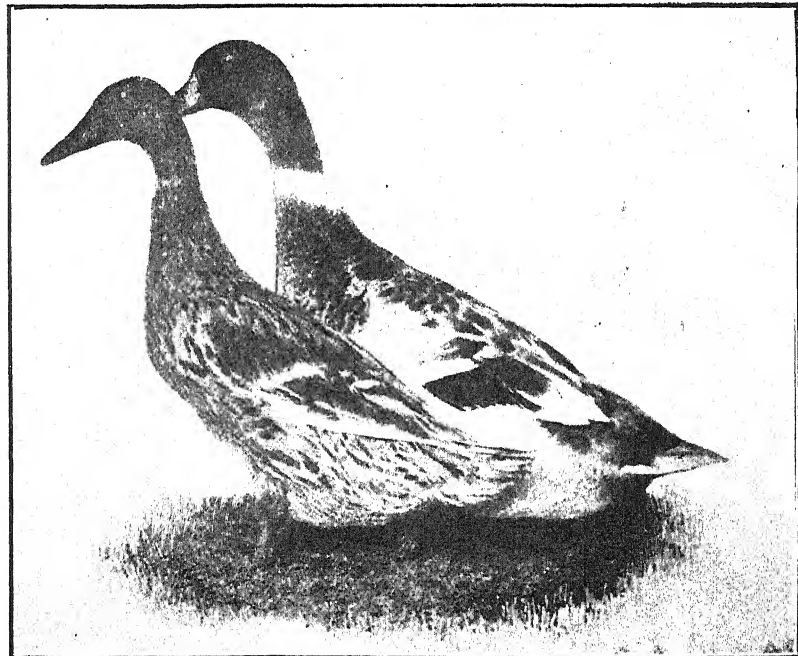
Rouen drake and duck. [From Wright's book of poultry.]





Pekin ducks.

Indian Runner ducks.



Khaki-Campbell duck and drake.





to those employed with hen eggs, except that duck eggs require a lower temperature, namely, 102 to 102½ degrees F. at the commencement, and after the second week a temperature of 103 to 103½ degrees F. would do no harm to the embryo ducklings. It should also be remembered that duck eggs require more moisture than hen eggs do. The egg shell of the former being thinner and more porous, evaporation of the contents is thus greater and more rapid in dry weather. It therefore becomes necessary to spray the floor of the incubator room with water, in addition to the moisture supplied in the water tray of the machine. When broody hens are used for hatching purposes, moisture can be supplied by digging a hole two or three feet deep and three feet in diameter where the nest is to be placed. Pour in four or five gallons of water and replace the soil, and when the hole is filled up make a concave depression in the loose soil and line it with clean straw or grass; the nest is then ready for the eggs. The warmth from the body of the hen will draw up the moisture from below the nest; beyond this, the eggs will not require additional moisture unless the weather be very dry and windy, when the eggs may require sprinkling with tepid water during the last week of incubation. The incubation period of duck eggs is 28 days, during which time the eggs should be tested twice, namely, on the fifth or sixth day, and again on the tenth or twelfth day of incubation.

Ducklings generally chip the shell from twelve to thirty-six hours before making their exit, during which time they are absorbing the remaining yolk for their support immediately after hatching. When necessary to open the incubator drawer morning and evening, the chipped part of the eggs should be turned upward. If this is done quickly, gently and without too long exposure, and if the ducklings are not hatching out easily, the fractures should be examined to see if the lining membrane of the eggs is too tough. If so, a little discreet assistance by opening the shell without causing bleeding may help matters. It is not advisable, however, for the incubator to be opened at hatching or any other time oftener than is absolutely necessary, that is to say, twice daily about 12 hours apart, for any purpose whatsoever, as far more harm than good is likely to be done. Ducklings are longer in getting clear of the shell than chicks, therefore the operator should not be unduly anxious. Keep the temperature of the machine up, as there is greater danger of chilling wet and half-dry ducklings when the drawer is frequently opened and the temperature thereby being reduced.

\* During the time of hatching there should be plenty of moisture in the egg chamber, so much that it will condense on the ventilation holes, or in some machines on the glass of the door. If the orifice made by the duckling in the shell dries, the duckling may become attached to it and be unable to work its way out. When the hatch is well advanced the ducklings should be taken from the drawer and placed in the drying box or in the nursery below the egg tray. This should be done morning and evening during the hatch, the dry ducklings only being removed to the drying box or nursery, where they should remain for 24 hours after the hatch is complete, when they may be removed to the brooder.

**Rearing and Feeding.**—The future of young ducklings depends first on the stamina and condition of the breeding stock and next on how they may be treated during the first ten days of their existence. As a general rule ducklings require less warmth than chicks, but they must be kept dry. They can be raised very satisfactorily in cold brooders similar to those used for brooding chicks. Attention should be drawn to the fact that young ducklings are very susceptible to sunstroke, and they should thus have access to plenty of shade. For young ducklings a small run covered on top to supply shade is desirable for this purpose. After a week old the ducklings need not be strictly confined to the hover during the night in warm weather, which will not only be a means of increasing ventilation, but during moonlight nights especially they prefer to make periodical visits to the food trough, in which dry mash should be placed. A shallow vessel containing water must also be accessible and placed a little distance away from the dry mash, when they will run to and fro and return to the hover again for warmth. This practice is a very desirable one and should be encouraged, as by this means the ducklings will make remarkably quick growth, which is essentially required for market ducks. They must have constant clean water, and they will probably insist on spilling and fouling it; this may be avoided to some extent by providing circular jam tins inverted in suitable vessels or saucers, which is the best means of supplying water. If these are placed on a board the litter is to some extent protected. The first feed should consist of fine grit, which should be given in the drying box of the machine; and when removed to the brooder a little grit may also be placed in a shallow vessel containing drinking water. When the ducklings are 24 hours old they will be ready for their first feed of mash, which may consist of—

- 2 parts wheaten bran;
- 1 part mealie meal;
- 1 part pollard or ground nut meal;

moistened with skimmed milk or warm water. If skimmed milk is unobtainable, add  $2\frac{1}{2}$  per cent. meat meal, alternate with boiled rice or stale bread crumbs moistened with milk, and a little fine grit sprinkled in it would serve as a variety.

Ducklings must be fed frequently and regularly during the first few days; make sure they begin to feed, for sometimes they are slow in doing so. Do not on any account allow the food to lie about and become stale and sour, as this will prove very harmful to the ducklings. After the first ten days 5 per cent. meat meal or cooked minced meat and plenty of finely-chopped tender green food may be added to the mash with advantage. A little chick grain may be given once a day in the drinking water with the grit when they are three weeks old. The ducklings which make good, rapid and vigorous growth and show a symmetrical development should be selected for next season's breeding, and at six weeks old they should be separated from those that are intended for the market and continue to feed as above. Place them in a large, well-shaded enclosure to develop naturally and to have plenty of exercise during the day. At eight weeks old allow them to have free range, and after the breeding season they may be

turned out with the older ducks to forage about for most of their food. The ducklings that are intended for the market should not be allowed access to swimming water, and should at the age of six or seven weeks, when their frames are sufficiently grown, be confined in a small enclosure without over-crowding, and fed with the object of fattening them. Then they may be given the following mixture--

- 3 parts mealie meal;
- 1 part bran;
- 1 part cut green food;
- 10 per cent. meat meal;

to which add a little powdered charcoal.

They must have a constant supply of drinking water and grit, and of course they must have shade. It is better to leave them a little hungry than to over-feed them. Fifteen to twenty minutes is time enough for them to eat all they should three times a day, and whatever is left should be removed. Ducklings fed in this way should weigh 5 lbs. to 6 lbs. at eight to ten weeks old.

Do not keep them longer than ten weeks old. Let this be the limit, for they then begin to grow their adult plumage and the pin feathers, which at this age start to grow, and which for the next six weeks will require a lot of nourishment for their growth, the result being that the ducklings do not put on any more weight. The food they consume would thus be wasted and add so much to their cost that instead of showing a profit they would show a loss.

An effort should be made to commence hatching as early as possible in the breeding season, and produce consecutive batches of ducklings for market throughout the season. Market birds of the same ages and as near as possible uniform in size and value at a time.

## A Calendar of Farm Crop Sowings.

By C. MAINWARING, Agriculturist.

The aim in issuing this sowing calendar is to provide farmers, and more especially new settlers, with guidance as to seasonable sowing operations on the farms. The season, however, properly determines the dates of plantings, but it is hoped that this calendar will be suggestive to the beginner, to whom any fixed points or standards, of whatever kind, are valuable in enabling him to plan his work. The farmer long accustomed to a locality depends less on a calendar than on the general state of the weather and the "signs" of the season. Rainfall and climatic conditions vary so much in different districts of the Territory that it is not possible to fix arbitrary dates of seeding. In regions of light rainfall special attention should be given to the preparation of the seed bed. Almost all crops thrive better when drilled than when broadcasted, since the seed, being planted at a uniform depth, germinates more evenly, and cultivation is rendered easier. Farmers are advised to use home-grown selected seed wherever possible. Change only for the purpose of getting a better variety of known value. The Department of Agriculture desires emphatically to urge upon the attention of farmers the absolute necessity of using none but pure clean seeds, true to varieties ordered. Especially should a guarantee be insisted upon that all seeds purchased are free from such noxious weeds as wild oats, darnel, etc. Good seed is a determining factor in the production of maximum crops.

*Barley* (winter irrigated or on moist vleis soils) for green fodder. Popular variety, Cape six-rowed. Sow April, May, June; 70 lbs. drilled, 80 lbs. broadcast; crop ready for first cutting,  $3\frac{1}{2}$  to 4 months.

*Barley* (winter irrigated or on moist vleis soils) for grain. Popular variety, Cape six-rowed. Sow May; 60 lbs. per acre drilled, 65 lbs. broadcast; period of growth,  $4\frac{1}{2}$  months.

*Beans, Haricot.* Popular varieties, Red Canadian Wonder, White Canadian Wonder, Natal Sugar. Plant December to January; plant 40 lbs. per acre, in rows 2 ft. apart by 8 ins.; period of growth, 3 months.

*Beans, Tepary.* Mid-November to January; 25 lbs. per acre, in rows 2 ft. 4 ins. by 8 ins.; period of growth,  $3\frac{1}{2}$  months. Very drought resistant.

*Beans, Velvet* (for green manure or hay). Sow November to January; 25 lbs. per acre, in rows 3 ft. by 10 ins.; period of growth, 4 to  $4\frac{1}{2}$  months.

*Beans, Velvet* (for seed). Popular variety, White Stingless. November to December. Sow 25 lbs. per acre, in rows 3 ft. by 10 ins.; period of growth, 5½ months.

*Beans, Dolichos* (for green manure or hay). Popular varieties, brown or white seeded. Sow November to December; 20 lbs. per acre, in rows 3 ft. by 10 ins.; period of growth, 4½ to 5 months.

*Beans, Dolichos* (for seed). October to mid-November; 20 lbs. per acre, in rows 3 ft. by 10 ins.; period of growth, 6 months.

*Beans, Kaffir, or Cow-peas* (for hay or green manure). November to December; 30 lbs. per acre, in rows 2 ft. by 8 ins.; period of growth, 3 to 3½ months.

*Beans, Kaffir, or Cow-peas* (for seed). November to December; 20 lbs. per acre; rows 3 ft. apart by 8 ins.; period of growth, 4 to 4½ months.

*Beggar Weed* (for pasture or hay). Mid-November to December; 15 lbs. in rows 8 to 10 ins. apart, or 20 lbs. broadcast; first cutting, 3 months from seeding.

*Buckwheat*. Popular variety, Japanese. Sow January; 30 to 40 lbs. per acre broadcast; period of growth, 10 to 12 weeks.

*Carrots* (for stock food). Popular varieties, James' Intermediate and White Belgian. December to January; drilled in rows 12 ins. apart, 8 lbs. per acre; period of growth, 4 months.

*Chicory*. Popular variety, Long Madeberg. November to December; 4 lbs. per acre in drills; period of growth, 4½ to 5 months; thin out plants to 6 ins. apart.

*Chillies*. Popular variety, Cayenne. Sow in beds November to December; transplant 2 ft. 6 ins. apart in rows; period of growth, 4½ months.

*Dhal* (for green manure on the sand veld). November to December; 30 lbs. per acre, drilled or broadcast; plough under when 2 to 3 ft. high.

*Dhal* (for grain). November; 6 to 8 lbs. per acre, planted in rows 3 ft. apart in frost-free situations; period of growth, 6 months.

*Ground Nuts*. Popular variety, Spanish Bunch. November to December; 30 lbs. of shelled nuts per acre in rows, as near as will allow for easy cultivation; period of growth, 4½ months.

*Hibiscus* (for fibre). November to December; 40 to 50 lbs. per acre; period of growth, 5 months.

*Linseed* (for seed). Popular varieties, white flowering and large-seeded. November to January; 25 lbs. drilled, 30 lbs. broadcast; period of growth, 3 months.

*Lucerne* (for green food or hay). Popular variety, Provence. Sow April, May, June; 20 lbs. broadcast; first cutting, 3 to 4 months from seeding.

*Kaffir Corn*. Popular varieties, Bird Proof and White Sudan. Sow mid-November to December; 5 lbs. per acre, rows 40 ins. by 18 ins.; period of growth, 4½ to 5 months.

*Maize* (for grain). Popular varieties, Hickory King and Salisbury

White. Mid-November to December; plant 12 lbs. Salisbury White, 15 lbs. Hickory King per acre, rows 40 by 18 ins.; period of growth, 5 months.

*Maize* (for ensilage). Mid-November to January; 25 lbs. per acre drilled; ready for cutting in about 4 months from planting.

*Maize and Velvet Beans*, combination (for ensilage). Mid-November to December; 15 lbs. of velvet beans planted in rows 3 ft. by 18 ins., followed at the same time with 15 lbs. of maize to the acre in the same row to allow for easy cultivation; ready for cutting in about 4 months from planting.

*Mangels* (for stock food). Popular variety, Mammoth Long Red. December to January; 8 lbs. of seed to the acre, drilled in rows 2 ft. 6 ins., and the plants thinned out to 10 ins. in the row; period of growth, 5 months.

*Millet or Manna* (for forage). Popular variety, Boer Manna. December to January; 15 to 20 lbs. broadcast; period of growth, 4 months.

*Oats* (irrigated or on moist vlel soil) for grain or forage. Popular varieties, Kherson, Burt or Boer. April to May; 65 lbs. drilled, 75 lbs. broadcast; period of growth,  $4\frac{1}{2}$  months.

*Oats* (on moist vlel soil). pasture for sheep. Popular varieties, Kherson or Boer. February, March, April; 70 to 80 lbs. per acre; grazing, 2 months from sowing.

*Oats*. Sown broadcast in maize crop during last cultivation for winter grazing; 60 lbs. per acre.

*Oats* (summer) for hay or forage. Popular varieties, Kherson or Burt. January; 60 lbs. per acre; period of growth,  $3\frac{1}{2}$  months.

*Onions*, main crops (under irrigation). Popular varieties, Natal Red and Yellow Cape. January to March or August to September; 10 to 12 ozs. per acre. Sow in beds and transplant when as thick as a lead pencil in rows 1 ft. 6 ins. apart and 9 ins. between the plants; period of growth,  $4\frac{1}{2}$  months.

*Peas* (summer). Popular variety, Black-eyed Susan. November to January; 60 to 70 lbs. per acre. Sow in rows 2 ft. 4 ins. apart; period of growth, 4 months.

*Peas* (winter, under irrigation). Popular variety, Yorkshire Hero Marrowfat. March, April, May; 70 lbs. per acre in rows 2 ft. 4 ins.; period of growth, 4 months.

*Potatoes* (early, irrigated or on moist vleis), as soon as frosts permit; 1,000 to 1,200 lbs. per acre. Tubers planted in rows 2 ft. 4 ins. by 1 ft.; period of growth,  $3\frac{1}{2}$  to 4 months.

*Potatoes* (main crop). November to January; 1,000 to 1,200 lbs. per acre, according to size of seed; period of growth, 4 to 5 months.

*Pumpkins and Cattle Melons* (stock food). November to December; 4 lbs. per acre, 8 ft. by 8 ft. between the plants. Cattle melons succeed best with light rainfall; period of growth, 5 months.

*Rye* (irrigated or on moist vlel soil). March, April, May; 60 lbs.

per acre; period of growth,  $3\frac{1}{2}$  months for green food and 4 months for grain.

*Rice* (on moist sandy vleis). November to December; 40 to 60 lbs. per acre; period of growth,  $4\frac{1}{2}$  months.

*Rapoko*. November to December; 3 to 4 lbs. drilled, 10 ins. between the rows, or 5 lbs. broadcast, mixed with damp earth or sand; period of growth, 4 months.

*Sudan Grass* (for hay). Mid-November to January; 20 lbs. per acre broadcast; first cutting,  $3\frac{1}{2}$  months from sowing; succeeds best with moderate rainfall; very drought resistant.

*Sudan Grass* (for seed). Mid-November to December; 10 lbs. drilled in rows 2 ft. apart; period of growth,  $4\frac{1}{2}$  months.

*Sunn Hemp* (for green manuring). Mid-November to January; 30 lbs. per acre drilled or broadcast; plough under during early flowering stage.

*Sunn Hemp* (for seed). Mid-November to December; 30 lbs. per acre; period of growth, 5 months.

*Sunflower*. Popular variety, Black. Mid-November to December; 10 to 12 lbs. per acre. Sow in rows same as maize and thin out plants when 6 ins. high to 12 or 15 ins. apart; period of growth,  $4\frac{1}{2}$  months.

*Sugar Beet* (irrigated). January to February; 15 to 20 lbs. per acre; sow in drills 2 ft. apart; period of growth, 5 months.

*Sweet Potatoes*. Plant cuttings as soon as obtainable during the rains in rows 3 ft. by 2 ft.; period of growth, 4 to 5 months.

*Teff Grass* (for hay). Mid-November to January; 6 to 8 lbs. per acre; broadcast with grass seed barrow drill; first cutting, 3 months from sowing.

*Vetches* (on moist vlei soils for stock food). March to May; 25 to 30 lbs. per acre.

*Wheat* (irrigated or on moist vlei soils). Popular varieties, Gluyas Early, Wit Klein Koren. Sow in May; 50 to 60 lbs. per acre; period of growth,  $4\frac{1}{2}$  to 5 months.

### GRASSES.

*Napier Fodder* (cuttings or root divisions), any time during the rainy season, in rows 3 ft. by 3 ft. apart.

*Kikuyu Grass* (cuttings or root divisions), any time during the rainy season, in rows 2 ft. by 2 ft. apart.

*African Star Grass* (runners), during the rainy season, in rows 2 ft. by 2 ft. apart.

*Swamp Couch* (runners or root divisions), during the rainy season, 2 ft. by 2 ft. apart.

*Rhodesian Tussock* (root divisions), during the rainy season, 1 ft. 6 ins. by 1 ft. 6 ins. apart.

*Molasses Grass*. Sow in shaded seed bed with the first rains, and transplant in rows 2 ft. by 2 ft. apart before the rains are over.

*Paspalum* (on black turf vleis). December to January; 15 lbs. per acre broadcast.

## Heartwater.

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[So far this disease has not been recorded in Southern Rhodesia, but the tick which transmits it has become established in the Gwanda and Wankie districts, and outbreaks may occur at any time. As cattle owners as a rule are not familiar with the disease, the following notes are reproduced from Mr. C. R. Edmonds' book, "Diseases of Animals in South Africa," by kind permission of the author.—Ed., R.A.J.]

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**History.**—The disease has been recognised in South Africa between forty and fifty years, and so far as is known it is peculiar to the country. By far the greater proportion of the country is free from the disease, it being found only in those localities where the bont tick (*Amblyomma hebraeum*) exists. The districts affected are mostly the coastal ones, the Eastern Province of Cape Colony, the Transkeian territories, parts of Zululand, and the bush veld in the Transvaal, and Bechuanaland also harbours the disease.

**Nature.**—The disease is a specific febrile one, very similar in many respects to the plasmosis, but the causal organism belongs to the class known as ultra-visible, in that it cannot be seen with the aid of the highest power of the microscope, therefore its presence has to be presumed; but Lounsbury has clearly demonstrated that the disease is transmitted by blood inoculation; the presumption that the disease is due to an organism or virus is apparently well founded.

The disease affects sheep, goats and cattle, mostly calves, but a varying resistance is exhibited by the different breeds. Amongst the goats, the Angora is the most susceptible, and in the sheep the Merino is more susceptible than the Africander, whilst the so-called Persian (which is really the black-headed Somaliland sheep) possesses a considerable degree of resistance, and although the animal can certainly be infected with the disease experimentally, yet it rarely contracts the disease in fatal form under natural conditions.

**Symptoms.**—The disease is ushered in by a rise in temperature, which is high—from 104 degrees to 108 degrees F., 106 degrees being fairly common. After this temperature has persisted for a day or longer, the ordinary symptoms of illness begin to appear; the affected animal will appear dull, lag behind the flock, and will remain quiet if left to itself. In many, if not a majority of cases nervous symptoms present themselves at first in the form of nervous excitability and bleating, followed by fits or series of fits, in one of which the animal frequently expires. During a fit the eyes are dilated, squint, or rotate in their sockets; the jaws may be closed, or there may be an in-and-out movement of the tongue or chewing movements of the jaw, twitching of



the muscles, loss of control over the limbs; the animal falls to the ground with the head twisted to one side or back towards the withers; it moans and bleats piteously, and executes galloping movements with the legs.

In some cases the first intimation of the presence of the disease is the finding of an animal dead in the kraal or in the veld. The appetite is usually not entirely lost, although rumination may cease early in the attack, and the animal will generally feed a little. The pulse and breathing are accelerated, and the exudation of the fluid into the heart sac, from which the disease takes its name, is denoted by a fall in the temperature, which drops below normal before death, and by uneasiness in the animal, manifested by lying down and getting up again. As the fluid increases in quantity the breathing becomes more laboured.

In sheep, when the disease is somewhat chronic in its progress, the wool becomes easily detached from the skin, and if the wool is grasped to restrain the animal, it comes away in handfuls. The symptoms are most pronounced in goats; in cattle they are similar, but not so well marked.

**Post-mortem Appearances.**—On making a *post-mortem* examination the most striking symptom is the presence of a clear, straw-coloured fluid in the heart sac. This may amount to as much as half a pint, but is usually less; it is not invariably present, but it is usually so, hence the name given to the disease. An exudation of this fluid frequently takes place into the chest cavity, less so into the abdominal cavity, and into the connective tissue adjacent to the larger veins, the neck being the site that is oftentimes infiltrated in this manner. This straw-coloured fluid is often tinged with blood, and a peculiarity exists with it when compared to dropsical effusions found in the same places, in that it coagulates quickly when exposed to the air, and when placed in a vessel it may do so in the space of a few minutes. The fourth stomach is congested, and a patchy congestion of the small intestines is often found, with the spleen slightly enlarged and the liver somewhat congested. The heart is usually pale, but otherwise normal. The lungs are pale, and the lobules may be slightly separated by the fluid.

**Incubation.**—The period that elapses between the inoculation of virulent blood until a fevered rise in temperature is shown is from eight to ten days. The period of incubation after successful tick infestation in the laboratory is from eleven to eighteen days; after natural tick infestation on the veld, fourteen to twenty days.

**Treatment.**—Medicinal treatment up to the present has not proved successful, and despite a number of experiments an economic system of preventive inoculation for this disease still awaits discovery; therefore, as in the case of East Coast fever, the only effective method of suppressing the disease is to get rid of the ticks, and the best way to do this, so far as is known at present, is by a campaign of regular, systematic and effective dipping of animals in an arsenical dipping solution of effective strength, and at sufficiently short intervals to accomplish the purpose. If this process of tick destruction had to be accomplished only by the means of dipping the sheep and goats on the farm, it would be an arduous one; but the bont tick is a greedy feeder, and will suck

blood from most animals; therefore the big stock, particularly cattle, act as traps for conveying the tick to the dipping tank and destruction.

Practical experience has proved that by ridding land of ticks by the regular dipping of cattle the farming of small stock afterwards on such land is both possible and profitable, and a quantity of land has been, so to speak, reclaimed to economic farming practice by the dipping tank. This has been particularly noticeable in the coastal area of the East London district of the Cape Province, where large areas have been reclaimed for grazing sheep through the destruction of bont ticks, which has been effected by the enforcement of dipping cattle for the prevention of East Coast fever.

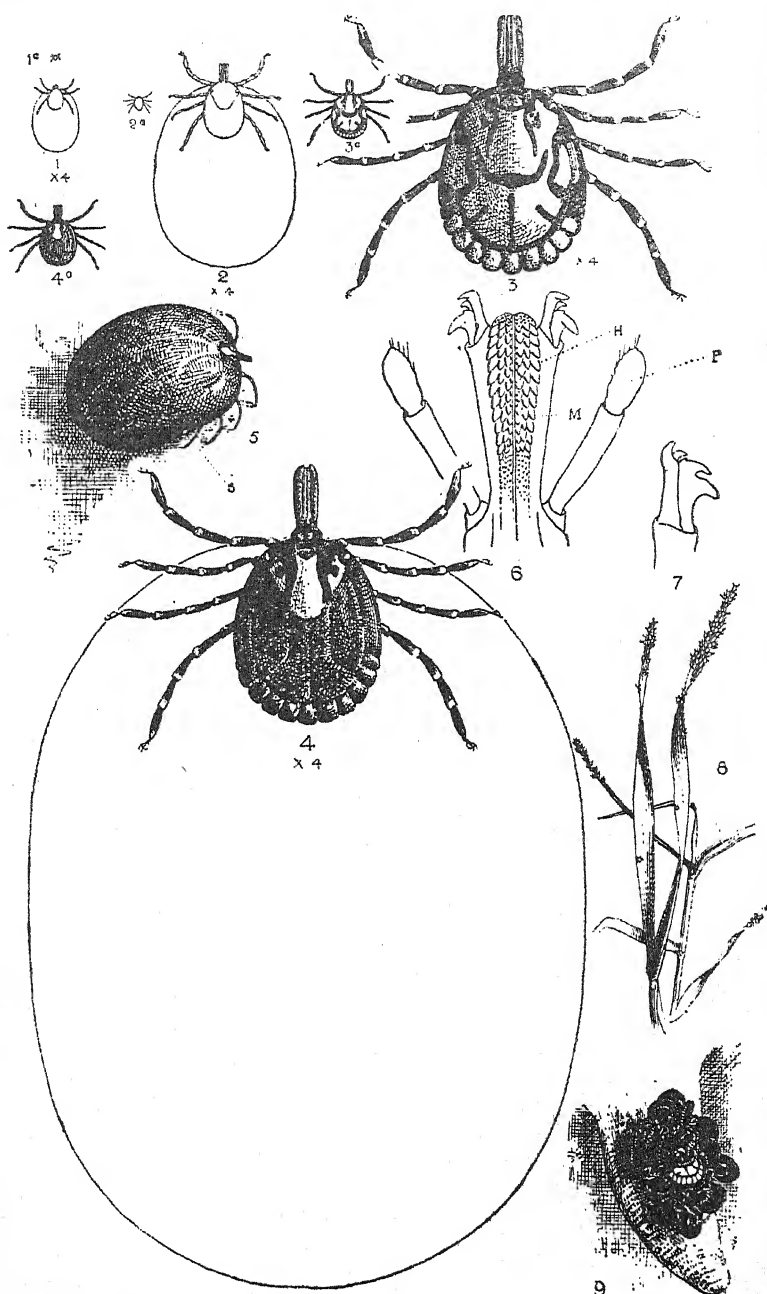
### THE BONT TICK (*Amblyomma hebraeum*, Koch).

The following notes on the bont tick are reprinted, slightly adapted, from Bulletin No. 402 of this department, entitled "Ticks Infesting Domestic Animals in Southern Rhodesia," by the Chief Entomologist:—

The male of this species is easily recognised by the pattern on the shield, the dark markings being dark brown, nearly black, and the lighter portions pale green in the middle, merging into pale yellow towards the edges (see plate). The legs are banded as in the preceding species (*Hyalomma aegyptium impressum*, C. L. Koch). In the female the markings on the shield are more variable. The plan of the markings on an average specimen is shown on the plate. Professor Neumann, the French authority on ticks, described the shield as exhibiting a large light spot towards the hinder end, and other small ones towards the sides. The remainder of the back of the tick in the unfed female is dark brown.

The length of the male and unfed females, including the mouth-parts, is about one-quarter of an inch, and the breadth about three-sixteenths of an inch. The engorged female usually measures about three-quarters of an inch long and five-eighths of an inch in breadth.

The life history of the bont tick is of the three-host type, both moults being passed through away from the host. The larvæ and nymphs feed on the same hosts as the adults. The duration of the different stages has been worked out in detail by Mr. C. P. Lounsbury in the Cape Colony. The female tick lays an enormous number of eggs, upwards of 17,000 having been computed in a single batch. The incubation period of the eggs varies very greatly with the temperature. In the winter it may occupy six months or more, and in the summer a period of about eleven weeks has been noted. The larva feeds for from four to nine days, but usually six or seven, before detaching itself, to drop to the ground for its moult. At this stage of its development it measures about one-twelfth of an inch in length. The time occupied in the moulting process varies in relation to the temperature and possibly other factors. It has occupied as little as sixteen days, when the ticks were kept in an incubator, and several months during the winter at ordinary atmospheric temperature. In nature it is thought that the period would vary between one to three or more months. The nymph or second stage tick engorges in from four and one-fourth to



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eight days, and, like the larva, drops to the ground for the ensuing moult. Lounsbury mentions periods of eighteen, twenty-two, twenty-four and twenty-eight days for this second moult, but adds that the time varies considerably with individuals, some treated in exactly the same way taking a fortnight longer than others over the process. This second moult brings the tick to the adult stage. The females only bite in readily next to a male that has been attached for some days. They then take some seven or eight days to feed to repletion and drop off to lay their eggs on the ground. The males remain attached to the host for a prolonged period.

As far as the complete life cycle is concerned, Lounsbury judges that in the Cape Colony there cannot be more than one complete generation in a twelvemonth, and that "under exceptional circumstances two full years might pass and the cycle be still incomplete."

The bont tick is found mainly in south-eastern and eastern Africa. It is not known to occur naturally in Southern Rhodesia, but males have been taken from animals introduced from the South African Union some months earlier under conditions that leave a doubt as to whether the infestation took place in this Territory or not. The bont tick is found in Bechuanaland, and there seems no reason why it should not become established in parts of this Territory, except that it must have been introduced freely in the past, and is not yet in evidence.

The bont tick was shown by Lounsbury to be the transmitter of the disease known as heartwater, which attacks sheep, goats and calves in parts of the South African Union. The tick conveys the disease from stage to stage, and not through the egg; that is to say, larvæ and nymphs which feed on a sick animal acquire the virus of the disease, and the resulting nymphs or adults, as the case may be, transmit the disease when they "bite" susceptible animals.

The bont tick in the adult stage has been recorded from cattle, sheep, goats, swine and horses, amongst domestic animals, and rhinoceros, giraffe, various antelopes, buffalo, lion, wild dog and other carnivora. It has also been found on a "Monitor" lizard.

#### *Explanation of Plate.*

1. *Larva*, four times natural size; 1a, natural size.
2. *Nymph*, four times natural size; 2a, natural size.
3. *Male adult*, four times natural size; 3a, natural size.
4. *Female adult*, four times natural size; 4a, natural size.

The hair lines about 1, 2 and 4 show the size to which the respective stages of the tick swell by the absorption of blood. Compare 1 without its hair line to 4 with the hair line to gain an idea of the enormous growth of the female; the increase is about 40 times in length and about 40,000 times in bulk.

5. *Fully engorged female adult*, natural size; s, spiracle or breathing orifice.

6. *Mouth parts of male adult* from below, about sixteen times natural size; p, palpus; h, hypostome or sucking organ; m, mandibles with mandibular hooks extended. The hypostome and mandibles penetrate the flesh as far as the base of the palpi. The hooks and a portion of the mandible itself are retractile, and each mandible may be used independent of the other; the hooks cut the hole into the flesh, and with the barbs of the hypostome enable the tick to cling tenaciously.

7. *Mandibular hooks of female adult.*

8. *Larvæ* or young ticks on spears of grass.

9. *Male adult* with nearly a score of females clustered about him on the teat of a goat. The male is attractive to the other sex after he has fed about five days, and then a number of females may settle about him as in the present instance; that the functions of the teat may be permanently impaired by such gross infestation is easily imagined.

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## Export of Citrus Fruits from Rhodesia.

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In the consignments of oranges despatched this season from Rhodesia to Capetown during May and June for shipment oversea, a large number of cases were rejected at the port by the inspectors owing to the fruit being in a wasty condition. It is fortunate that the bulk of oranges for export from Rhodesia are of mid-season and late varieties. The only oranges that have suffered from this trouble are the early varieties, and that mainly one variety, viz., Washington Navel, which is the main early export variety. Some little trouble was experienced with Mediterranean Sweet and Jaffa varieties, but only the earliest consignments of these. As a matter of fact the trouble practically ceased by the middle of June, although it lasted in some parts for several weeks, since which time no rejections have occurred.

The season for the export of oranges from Rhodesia lasts from May to October inclusive, and it is satisfactory to note that oranges from Africa, speaking generally, realise higher prices on the English markets during September, October and November than during the earlier half of the season.

The citrus adviser, Mr. A. G. Turner, was sent to Capetown to investigate matters, and the following is his report:—

The system followed by the fruit inspectors is laid down in the regulations covering the export of citrus fruit from any port of the Union of South Africa. On arrival at the docks five per cent. of any and every consignment is drawn out indiscriminately by the inspectors, and each box of this five per cent. is examined right through, *i.e.*, every fruit is examined. If the fruit is poor quality, badly sized and packed, or wrongly graded, the inspectors can degrade or reject the whole consignment, and the same applies if wasty fruit is found in such quantity and condition as to endanger the good carrying of the fruit. As a general principle, however, if the first five per cent. is found, on examination, to be on the border line, a further five per cent. is drawn from the same consignment, when the whole is either passed for export or rejected.

On account of large quantities of oranges arriving at Capetown for export being rejected by the Government inspectors, due to excessive percentage of waste, the Fruit Growers' Exchange started a re-packing depot, as it was felt that if these wasty consignments were gone through and re-packed, the majority would pass inspection and could then be exported. The Government inspector considers such re-packed fruit as entirely new consignments, and consequently if poor quality, sealy or otherwise blemished fruit were re-packed and offered for inspection, it would be again rejected.

About 12 per cent. to 15 per cent. was being thrown out by this re-packing depot, a proportion of which, about a half to a third, was being disposed of on the local markets, the balance being completely broken down and mouldy, approximately 85 per cent. being sent for re-inspection for export, and to the best of my knowledge was all passed.

An inclusive charge for this re-packing has been fixed at 2s. per box, covering rent of store accommodation, carting from cold stores to re-packing depot, and re-carting from depot to cold stores or docks, labour for handling same and the actual sorting and re-packing; it is reckoned about 40 per cent. rebate will be made to Exchange members on this charge at the end of the season.

A difficulty arose with regard to consignments *ex farm* being rejected and put into cold storage until re-packing depot was ready for same, when a week's rent was charged on these same consignments; having been re-packed, they were brought back to cold storage and charged for again as a new consignment. It was pointed out by the cold storage people that as soon as a consignment left their store for re-packing it was written off their books; on return of fruit from re-packing depot it was put into cold storage as a new consignment as having to be handled a second time, and rent charged accordingly, namely, 5s. per cubic ton per week or part thereof. An arrangement was finally agreed to by the cold storage companies that on arrival *ex farm* the charge of 5s. per ton would be maintained, but on being re-stored from re-packing depot the charge would be 2s. 6d. per ton, a considerable concession on the part of the cold storage companies.

This re-packing has been carried out under great difficulties, the available accommodation being very limited, while labour employed was entirely inexperienced. At first a bonus was being paid for

packers, but was stopped, as it was found sufficient care was not being used in sorting out bad fruit.

Other districts, where fruit was affected in similar manner to Rhodesian consignments, were Barberton, Pietersburg, Tzaneen and some other sections of Transvaal low veld, also Clan William, C.P., and South-West Africa.

The reason for oranges breaking down is undoubtedly due in the main to unusual seasonal conditions, which not only weakened the fruit in its carrying qualities, but also tended to elongate fruit so that good packing was extraordinarily difficult. Moth punctures may have been contributory causes to this general trouble in the very early season. I am convinced, however, the real cause of the breakdown is due to unusual weather conditions from January to March, when steady rains persisted, with little or no sun; while to aggravate these conditions, late rains occurred in April. Cover crops of great height and density due to continual wet, unless weather undoubtedly tended to make things worse in these difficult circumstances.

It is fortunate that such weather conditions as were experienced during last season are abnormal and unlikely to occur again in Rhodesia, except perhaps at rare intervals. It must be recognised that it is not the quantity of rain that fell, but the persistent wet weather, and especially the lack of sunshine. In consequence of all these unusual conditions early oranges have been abnormally full of juice and extraordinarily elongated, making packing very difficult, in that on ordinary pressure being exerted to put on the box lids, damage occurred.

Unfortunately this past season most groves from which early fruit has been rejected were planted to tall growing cover crops, sown too late, and not ploughed in until after cessation of rains.

In the instance of one place from which only one consignment was rejected, and that because two boxes showed considerable waste, the balance showing only one per cent., cover crops were sown early and ploughed in during a comparatively dry spell in January; thus although grass and weeds grew, the growth was not so profuse as to prevent a free access of air and whatever sun there was. On a part of another farm where similar conditions obtained, no rejections have occurred.

Fruit in varying and various stages of soundness and rot was submitted to a mycologist and an entomologist, neither of whom could give any lucid explanation of the trouble, but it was pointed out that some inherent weakness was evident, due to some unknown cause, the actual breakdown being caused by "blue mould" in almost every case.

In many cases the fruit had completely collapsed, and frequently the wastage was so great as to prohibit any fruit being used in a whole box for re-packing.

The only recommendations which seem useful are that all cover crops be sown early and ploughed in, if possible during any moderately dry period, such as almost invariably does occur between December and March, also that no tall growing crops be used for this purpose. Direct radiation is a necessary requirement for growing oranges. When fruit

is abnormally long-shaped, sizes should be reduced to shorter counts so that less pressure need be exerted in nailing up. Following such a season, irrigation should be delayed as much as possible, even on late varieties, and of course withheld entirely from early varieties until all fruit is picked.

Such unfavourable conditions as were experienced this last wet season are, happily for Rhodesia, most unusual, the only season when somewhat similar conditions obtained being that of 1908-9 in the Transvaal.

It may be safely said that our seasons are, generally speaking, extraordinarily consistent from a plant growing point of view as compared with many other agricultural countries. Take, for instance, Florida and California. In the former State whole areas of citrus were destroyed entirely by frost in several successive years, but to-day the industry is again thriving there, while in California frequent freezes occur and destroy 50 per cent. of the whole orange crop in some districts; this, however, does not deter growers from extending their plantings every year. Looking at our misfortune of this past wet season from the same angle, we are in a much more fortunate position; in America frost protection is a part of the regular costs, and even then crops are lost, whereas with us such occurrences as we have experienced lately are fortunately most unusual.

All growers should realise and appreciate the great benefit effected by the Fruit Growers' Exchange in inaugurating the re-packing establishment at Capetown, as had all rejected oranges been put on the local market, such a glut would have occurred as to depreciate values to very small prices, and in addition full rail charges of three times the export rate would have to be paid.

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## Napier Fodder.

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[The following notes on Elephant grass (or Napier fodder) are taken from the issues of the *Agricultural Gazette* of New South Wales for June and July, 1923. We have previously in this *Journal* published extracts from exchanges showing the value which is set on Napier fodder in America and Australia. It is surprising that this grass is comparatively but little used in Southern Rhodesia, the country in which its value as a grazing and fodder crop was first demonstrated.—Ed., R.A.J.]



"Elephant grass (*Pennisetum purpureum*) is a rapid grower that comes away early in the spring, and if it is eaten off or cut and fed to stock before it becomes too coarse, it provides a large amount of succulent feed. The best time to use it is when it is about 2 feet high. The amount of growth made by Elephant grass in a number of districts on the very limited rainfall of the recent dry season was remarkable, and is worthy of being recorded.

"Observations made at Hawkesbury Agricultural College, Richmond, showed that although the season was a particularly trying one, the grass proved its ability to produce fodder under conditions far from favourable to plant growth. From 1st August, 1922, to 28th February, 1923, only 7.94 inches of rain fell, whereas the average annual rainfall for the Richmond district is approximately 30 inches.

"An acre-paddock of Elephant grass, planted in March, 1919, with plants 3 feet apart each way in the field, was used for pasture milking cows during the period August to February, whenever there was sufficient growth on the area. The grass was allowed to attain a height of from 18 inches to 2 feet before the cows were turned in on it. The fodder at this stage was soft and palatable and relished by the stock. After the morning milking, the cows were put in the paddock and left there until about 2 p.m., just prior to the afternoon milking. At night they were pastured in one of the larger paddocks.

"Under these conditions the acre of Elephant grass made sufficient growth to allow of the cows being turned in on it three times during the seven months, each feeding period lasting a little over a week. Twenty-five cows were pastured on this area on the first two occasions, and fifty-three on the last, and by the 23rd March the paddock could be used again.

"Elephant grass thus showed itself to be of great value for cattle feed on the poor land in this district during a dry, unfavourable season; it maintained and in some cases increased the milk flow. Adjoining paddocks of lucerne made hardly any growth during the period.

"At Wollongbar Experiment Farm, near Lismore, two acres were planted with Elephant grass for pasture purposes some four years ago, but owing to an abundance of feed being available, very little use was made of the plot until the season under review, and the grass was allowed to grow to its maximum height of about 12 feet each year. At this stage of growth cattle simply pick the lower leaves off the stems, and the growth affords a certain amount of shelter for the stock during winter months. In September, 1922, however, the heavy top growth was cut with brush hooks, and the trash and stems left on the ground. This provided an excellent mulch and when tramped in by stock added humus to the soil. The young growth came away very rapidly, and although repeatedly stocked, this vigorous growth continued right through the dry period. The paddock was the only green patch on the farm.

"It was estimated that the carrying capacity of this grass right through the dry time was easily a beast to the acre. This test proved

conclusively that Elephant grass does well in the Richmond River district, in spite of continuous dry weather.

"In addition to this evidence from Government farms, numerous reports have been received from coastal farmers, in which it was stated that Elephant grass had proved very useful in providing green feed during the exceptionally dry period experienced, and in all cases it was mentioned that it was intended to sow an increased area to Elephant grass during the coming spring.

"The rainfall at Cowra Experiment Farm for the seven months' period September, 1922, to March, 1923, inclusive, was 7.75 inches, 4.2 inches of which fell in December. In spite of this fact, the plot of Elephant grass made good growth right through the dry spell, and cattle were turned in on it after the evenings' milkings for the periods 23rd January, 1923, to 19th February, and 7th March to 16th March. Up to the last feeding-off the grass had attained an average height of 3 feet, and at the end of March exhibited a growth of 9 inches, notwithstanding the fact that only 20 points of rain fell during the months of February and March."

Writing with regard to a plot of Elephant grass planted two or three seasons ago, Mr. H. A. D. Crossland, "Homewood," Quirindi, on 12th June, 1923, stated that though the past season had been extremely dry the grass had made a very favourable growth and appeared to thrive well even when heavily fed off. Since the beginning of April it had been irrigated and had made phenomenal growth—up to 6 inches in twenty-four hours. There was no other green stuff, and milking cows were grazed on it every second night, nipping the shoots right down. In the colder weather the growth was much slower, but whenever there were two or three warm days and nights it revived, and at the time of writing it was still sending up green shoots, though making very little growth. Under irrigation it appeared to produce more milk and butter as green feed than any other crop Mr. Crossland knew of, as long as it was not allowed to make rank growth. In the warm weather, under irrigation or favourable seasonal conditions, it could be relied on to produce 2 feet of growth in a week, and every week, though the second week's growth would be a little slower. If allowed to get rank and fed off, stock left butts about 4 feet high. The side shoots from such stalks made excellent feed, but it was wasteful to allow the stalks to grow very long in the first place.

In forwarding the above matter, Mr. J. N. Whittet, Agrostologist, remarked that the Department recommends feeding off or cutting Elephant grass when it is from 2 to 3 feet high. It is a mistake to allow it to make maximum growth before using it.

## Reviews.

### FIELD CROPS IN SOUTH AFRICA.

By H. D. LEPPAN, B.Sc.A., and G. J. BOSMAN, B.Sc.A.

Central News Agency: 21/- net.

In writing this book the aim of the authors has been to give a concise account of the cultivation of crops in the Union of South Africa in the hope that it will be of service to farmers and prospective farmers. This purpose will meet with the approval of all interested in the advancement of agriculture in South Africa, for there has long been a need for an authoritative work of this nature. Up to the present the South African farmer has had to seek for the information he requires in agricultural journals and bulletins issued by Departments of Agriculture. Admirably as his needs have been met in this manner, a book such as the one under review is certainly more convenient, and for this reason will doubtless be widely appreciated.

In acknowledging that a complicated subject has been dealt with in a comprehensive and able manner, we cannot help remarking upon certain statements which would appear to indicate that the authors are not as familiar with some crops as might be expected. For instance, in discussing the seeding of teff—page 285—it is suggested that the seed should be mixed with dry sand or silt. This practice is often adopted when the seed is sown broadcast by hand, but we have not heard of its being employed when the Cahoon seeder is used. The notes on the propagation of Napier fodder—page 294—are rather confusing, and might, we think, be more clearly expressed. In dealing with cultural methods in regard to sunflowers—page 318—the authors omit to state that branching is best overcome by the selection of heads from non-branching plants. The removal of the branches in the manner indicated by the writers can hardly be deemed practical. Again, the cutting of velvet beans by means of a spade—page 326—is surely unsatisfactory, sickles being more generally employed. In the statement regarding the uses to which the sweet potato can be put—page 337—the general value of this crop in the scheme of farm feeding is hardly given full justice, for both the tubers and tops are admirably suited for the feeding of cattle and pigs. Then the inference that irrigated wheat—page 250—requires a less well prepared seed bed than dry land wheat is perhaps liable to misinterpretation. We think as a rule in South Africa the tendency is to give insufficient attention to the preparation of the seed bed for all crops, and for the best results to be secured a good seed bed is surely as essential for an irrigated crop as for any other. The authors might, we think, have rendered their work more generally useful had they given more precise

information regarding the conditions suitable for the different crops which they discuss. By doing so they would have enabled their readers to judge of the suitability of each particular crop for their own locality.

The authors have drawn freely upon various well-known works of reference, and in this way much valuable information has been incorporated in the book. It is surprising, however, in view of the years which have elapsed since the inception of the Union experiment farms and stations, as well as the research branches proper of the Department of Agriculture, that practically none of the results of consecutive local crop experiments and investigations is given. It would be possible to point to other minor defects which should receive attention in a later edition, but taking the book as a whole we can say that it contains a fund of useful information and good advice, and should prove a valuable addition to the library of the South African farmer.

### SUB-TROPICAL AGRICULTURE IN SOUTH AFRICA.

By H. G. MUNDY, Dip. Agric., F.L.S.

Publishers: Argus P. & P. Co., Ltd., Salisbury: 12/6, by post 13/-.

Mr. H. G. Mundy, the author of this book, is well known to our readers. He has for many years been a member of the staff of the Department of Agriculture, and has contributed numerous articles to the pages of this *Journal*. He has been responsible for the crop experiments which have been carried out at the Government experiment farms, and in the course of his official duties he has personally visited the majority of farmers in the country. His knowledge of arable farming in Southern Rhodesia is thus very extensive, and he is able to proffer advice which has been tested and applied under ordinary farming conditions. In this book no attempt is made to present a highly scientific treatise on any of the subjects dealt with. Facts and deductions are stated in plain and unpretentious language, so that the veriest novice in farming matters can intelligently follow the reasonings. The writer's object has evidently been to supply the newcomer and even the more experienced farmer with a guide and reference book to those methods of farming which are now known to promise the best results. The book is restricted to sub-tropical agriculture, and with few exceptions all advice tendered is supported and confirmed by the results of actual experiments carried out in Rhodesia. In places there are evidences of haste and lack of as careful revision of proofs as is desirable in a work of this nature. A few typographical errors also occur. Fortunately these minor defects are confined relatively to unimportant details which in no way affect the validity of the reasoning. In all essentials the teaching is eminently sound, and the errors referred to do not seriously detract from the worth of the book, which can with advantage be studied by the majority of farmers in Rhodesia and adjoining territories.

The writer might perhaps have dealt rather more fully with the diseases and pests to which the different crops are subject. Limitation

of time or space may be responsible for this brevity, but it is a point which might be improved in subsequent editions. We should also like to see the irrigation of crops dealt with. On the other hand, a special feature has been made of supplying information regarding the suitability of each crop to varying soil and climatic conditions. This should prove particularly useful to the reader by enabling him to determine for himself which crops and systems of farming are best suited to his own particular farm. Throughout the author writes with complete conviction and with full regard to essential detail. We have every confidence that the book will succeed in its purpose, namely, the directing of farming thought towards more scientific methods of soil and farm management, and the guiding of the less experienced newcomer into the road which will ultimately lead to success.

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ELEMENTARY LECTURES ON VETERINARY SCIENCE FOR  
AGRICULTURAL STUDENTS, FARMERS AND  
STOCK-KEEPERS.

By HENRY THOMPSON, M.R.C.V.S., Lecturer on Veterinary Science  
at the Aspatria Agricultural College.

Pages xii., 543; Plates 54; Figures in the text 17. Publishers:  
Messrs. Bailliere, Tindall & Cox, Covent Garden, London.  
Price, 15/- net.

It is nearly thirty years since this work was first published, and that it is popular amongst the classes for which it is written is evident from the fact that since then several editions have been called for. The scope of the work is comprehensive, covering the diseases of all the domestic animals, with methods of treatment. It is divided into twelve sections, each section being devoted to one particular portion of the body, of which the general anatomy and functions are described, followed by a description of the symptoms and "first aid" treatment of the various ailments common to the part. Whilst of a very elementary nature, as the author admits, the work will probably be found more useful to the average stock owner than others of a more ambitious nature.

J. S.

# Southern Rhodesia Veterinary Report.

June, 1923.

## AFRICAN COAST FEVER.

CHARTER DISTRICT.—Fresh outbreaks occurred on the farms Inhoek and Swindon. The former adjoins the infected area Onze Rust, the latter five miles south of Totton, towards Enkeldoorn. The usual precautions were immediately taken and three-day dipping instituted. The following mortality occurred during the month:—Inhoek 9, Swindon 9, Onze Rust 93, Mangeni Reserve 8, Kopje Alleen 8, Commonage 1, Sabi Reserve 1, Stockdale 1, Rockydale 3.

MELSETTER DISTRICT.—Twenty head were destroyed on Morgenson.

## CONTAGIOUS ABORTION.

Outbreaks are reported from the following districts:—Salisbury, Mazoe and Marandellas.

## HORSE-SICKNESS.

The following mortality was reported:—Melsetter 2, Gwelo 3, Salisbury 3, Marandellas 2, Mazoe 8, Bulawayo 2, Plumtree 1, Essexvale 3, Hartley 2, Insiza 1, Inyati 1, Makoni 2.

## QUARTER-EVIL.

Outbreaks were reported from Gwelo, Selukwe, Mrewa, Marandellas, Fort Usher, Hartley, Nyamandhlovu and Umtali.

## EPHEMERAL FEVER.

Two cases reported in Salisbury and Victoria districts.

## SCREW WORM.

A few cases reported in Hartley district.

## IMPORTATIONS.

From the Union of South Africa:—Bulls 9, heifers 14, horses 161, mules 29, donkeys 32, goats 523, sheep 1,400.

## EXPORTATIONS.

To the Union of South Africa:—Slaughter cattle 2,374, horse 1, goats 209, pigs 69, sheep 69. To Northern Rhodesia:—Horses 2, donkeys 11, sheep 140. To Belgian Congo:—Goats 70. To Portuguese East Africa:—Horses 3, bulls 9, cows 75, heifers 10, goats 18, sheep 117.

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July, 1923.

## AFRICAN COAST FEVER.

CHARTER DISTRICT.—The following mortality occurred:—Stockdale 2, Hoffmania 2, Rockydale 1, Ferreiraton 1, Kopje Alleen 34, Onze Rust 25, Inhoek 4, Elminie 2, Swindon 24, Jackalsdraai 10, Altona 5. In the June report one death was reported on the commonage instead of on Ferreiraton.

## CONTAGIOUS ABORTION OF CATTLE.

Six fresh centres of infection reported.

## HORSE-SICKNESS.

The following mortality was reported:—Mazoe 2, Hartley 2, Gwelo 1, Umruma 3, Selukwe 2, Umtali 1, Makoni 1, Bulawayo 3, Plumtree 1.

## DISEASE OF GOATS.

The Director of Veterinary Research reports as follows:—

“The mysterious death of goats was reported to C. I. Morris, who sent in four dead animals for examination. The only constant lesion which was observed in these animals was a gelatinous infiltration of the lungs and accumulation of oedematous fluid in the thoracic cavity. In one case as much as two gallons had accumulated, and in the other cases there was quite a considerable amount. In three cases there was a slight engorgement of the villous membrane of the stomach, and in two pregnant animals there appeared to be an acute metritis.

“Four goats were purchased from a clean flock for experimental purposes and were inoculated as follows on the 7th instant:

No. 1.—10 cc. of fresh blood taken by C. I. Morris from a sick animal into special preservative.

No. 2.—10 cc. mixed tissue extract from three dead animals.

No. 3.—10 cc. serous fluid from the pleural cavity of dead animals.

No. 4.—Control.

“Although at the time of writing twenty-six days have elapsed since the inoculation, no ill effects have been observed.”

## IMPORTATIONS.

From Union of South Africa:—Bulls 66, heifers 35, horses 95, mules 46, donkeys 12, sheep 1,568, goats 649, pigs 19.

## EXPORTATIONS.

To Union of South Africa:—Slaughter cattle 4,678, horses 2. To Northern Rhodesia:—Horses 5, donkeys 20, goats 5. To Belgian Congo:—Sheep and goats 195. To Portuguese East Africa:—Horse 1, bulls 2, heifers 20, cows 24, donkeys 23, sheep and goats 135, pigs 24.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

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## Correspondence.

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To the Editor,  
*Rhodesia Agricultural Journal.*

Sir,

## MORTALITY OF HORSES.

There were a great number of deaths among horses last rainy season, and the wet season will be here again shortly. Will you kindly publish the following preventives which I have found to be sure?

Blue tongue and biliary fever in horses can be prevented by weekly dipping through the year in full strength cattle dips.

Dikkop can be prevented by giving a horse 25 grains of quinine every week through the wet season. I give it to my horses, which have salted on it, as follows:—Five 5-grain tabloids of quinine dissolved in half a tumbler of water. With this solution damp a few handfuls of coarse ground mealie meal and let the horse eat it in a crib basin or nose bag every week.

I am, etc.,

B. PRESCOTT.

P.O., Marula Siding,  
11th September, 1923.



## Agricultural Outlook.

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Reports go to show that stock have weathered the winter months very well, and that so far little hardship has been experienced. The heavy and late rains of last season ensured ample supplies of water and grazing which should suffice until the rains set in. Veld fires have fortunately been less in evidence this year, and consequently grazing has been preserved. Stock have naturally fallen off in condition and have never been so fat this year as in drier seasons, but they should soon recover if seasonable rains occur. The position of the cattle industry is still eminently unsatisfactory, and although prices have improved slightly, it is only because animals of a better type are being marketed, and in accordance with the usual rise in prices at this time of year. A solution of the problem as to the disposal of our surplus supplies is still awaited.

The export of maize is proceeding briskly, and up to the 8th September 516,582 bags had been sent to Beira for shipment. Of this total, 159,728 bags were No. 1 grade, 317,747 bags No. 2 grade, and 16,226 bags No. 3 grade. The number of bags rejected so far is 22,881. The percentage of No. 1 grade maize this year is rather low, due to the excessive and late rains which adversely affected the grain. There was virtually no maize exported from Southern Rhodesia last year owing to the drought, but in the whole period of 1921, when a total of 555,635 bags were exported, apart from 143,357 bags of maize meal, the percentage of No. 1 grade maize was 58.4. The crop this year is estimated to yield 1,447,000 bags, of which between 500,000 and 600,000 bags will probably be kept for local consumption. For the first time for some years African white flat maize is being quoted on the English market at a higher price than Argentine yellow flint maize. The Argentine crop this year is a short one, the official estimate placing it at 3,890,000 tons, compared with a yield of 5,386,030 tons in 1922. For the first five months of the current year 522,701 tons of maize were exported from the Argentine, as compared with 2,549,933 tons for the whole of 1922.

Winter cereal crops appear to have fared well, and harvesting is in progress. So far as can be estimated, the acreage is rather less than usual and sufficient to supply only a small proportion of our requirements of flour. The re-imposition of the duties may induce farmers to plant a larger acreage next season.

Farmers are advised to take measures to eradicate Mexican mari-gold, which will shortly make its appearance. The only way of dealing with the weed is by pulling it out by the roots and destroying it before

it seeds. Extremely good work in eradicating Mexican marigold has been done by school children at various centres. By their willing efforts large areas have been cleared of the weed, and the thanks of the community are due to scholars and principals alike. The weed is becoming a serious menace to farming operations, and energetic and sustained measures are necessary to keep it under control.

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## Farming Calendar.

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### October.

#### BEE KEEPING.

Bush bloom is now on, the queens consequently are laying vigorously. therefore give space and ventilation. In good districts, where stocks are strong, nectar may be coming in freely, and to prevent swarming it may be necessary to remove a crate of honey. By using the carbolio cloth, the operation is easily and quickly accomplished. At this season, whenever a crate of honey is removed, a properly fitted empty crate must take its place, otherwise the bees will swarm. Keep the apiary clear of weeds, and all hives well shaded. Feed any weak stocks.

#### CITRUS FRUITS.

Irrigation should be continued, followed by thorough cultivation, if no good soaking rains occur. From about the middle of this month to middle of next is the best time to plant orange trees, as they have hardened up their first growth, and if properly attended to will commence to grow right away, so that by the end of the growing season they will have put on considerable growth and established themselves well in the ground.

#### CROPS.

If ploughing has not been done earlier in the season, it should be undertaken as early as the condition of the ground will permit. A disc harrow or a roller should immediately follow the plough in order to break up the clods. In the case of new lands ploughed for the first time earlier in the season, an attempt should now be made to cross plough these. It is not safe or advisable to plant any summer crops during this month except on vlel soils. Winter wheats will be ready for harvesting, and the stubble should be ploughed in as soon afterwards as possible. Green manure crops should then be put in with a view to ploughing these down in December or early January.

#### ENTOMOLOGICAL.

*Maize.*—Where circumstances permit early growth of maize, crops planted late in October are liable to suffer in December from stalk-borer, especially

If only a few acres are involved. If maize can be planted early in October, the plants are usually large enough by December to outgrow serious damage. See "Maize Stalk Borer," *Agricultural Journal*, December, 1917. Cutworms are very apt to be troublesome in the wet vleis. See "Cutworms," *Agricultural Journal*, August, 1918.

*Tobacco*.—Cutworms, stem-borer, leaf miner and other caterpillars are liable to give trouble in the seed beds. See "Tobacco Pests of Rhodesia," *Agricultural Journal*, February, 1920.

*Potato*.—Avoid introducing root gallworm and potato diseases to valuable land under irrigation or to the home garden with seed potatoes. See "Diseases of the Potato Tuber and Selection of Sound Seed," *Agricultural Journal*, February, 1914. Growing plants in October may be defoliated by caterpillars, or the tops severely injured by the potato tuber moth. Spray with arsenate of lead (powder) 1 lb. to 30 gallons of water, or (paste) 1 lb. to 16 gallons of water.

*Cabbage, Turnip, etc.*, are apt to suffer severely from diamond back moth and webworm. Dust regularly with Paris green, 1 lb. Fresh water-slaked lime, 20 lbs. For cabbage aphid wash liberally, and wash plants regularly with a forceful stream of water from a hose or spray pump.

*Beans and Peas* are little attacked by insects at this time of year. If aphid (green fly) is troublesome the plants may be sprayed with soap wash or tobacco wash. Leaf eating beetles are best destroyed by hand.

*Cucumbers, Marrows, etc.*, may be attacked by leaf-eating beetles, which quickly destroy the young plants. The young plants may be protected by gauze covers. Once vigorous growth has started the damage is negligible.

*Citrus Trees* may be sprayed for scale after the fruit has set. Resin wash is the safest and most efficient spray. Fumigation is still more effective. Avoid using miscible oils for citrus spraying at this time of the year. Destroy out-of-season fruit on account of citrus codling moth. See "Rhodesian Citrus Pests," *Agricultural Journal*, February-April, 1916.

*Deciduous Fruit Trees*, including grape vines, are liable to attack by chafer beetles. Heavy spraying with lead arsenate (paste) 1 lb. to 10 gallons of water, or (powder) 1 lb. to 20 gallons, appears to afford considerable protection, but the leaves need thoroughly coating.

*Fig*.—Fruit infested with fig weevil should be collected regularly and destroyed.

## FLOWER GARDEN.

All flower seeds, annual and perennial, may be sown as in September. A word or two on open seed beds may not be out of place here. These beds should be prepared in a sheltered position, and the soil should be well and deeply dug. This is more essential than at first thought, as in this state the soil when once watered is more easily kept moist, and is not so liable to cake. The top dressing should be free from all undecayed vegetable matter, and when sown, the seeds should be covered with a thin dressing of fine light soil, over which a thin covering of grass may be placed to check evaporation. Transplanting from boxes or beds should be done on a dull day or towards evening; the plants should be well watered before being removed, and the roots disturbed as little as possible, care being taken that the latter have their full depth and spread when planting.

## VEGETABLE GARDEN.

As in September, nearly all vegetable seeds may be sown. Early potatoes should be earthed up when reaching the height of about eight inches. In planting a small amount of marrow, melon, cucumber, and pumpkin, the writer has found it economical to sow the seed one in a tin and transplant when about four inches high in hills. A few cucumbers planted in this manner yielded nearly 400 a week for about two months. Sweet corn and mealies may also be sown this month.

## FORESTRY.

Prick out into tins any trees that are ready. If the ground is soft enough, harrow and cross-plough the land broken up in the early autumn.

## POULTRY.

The early hatched pullets should now be commencing to lay. They should have been in their laying quarters a month ago in order to get used to them, for any change after they have started will stop them laying. It is much easier to stop a bird laying than to bring her on again, and she will probably go into a partial moult and not get over it for some weeks. If this happens, part of the advantage of early hatching has been lost, for a bird hatched in April, May or June will (if of a good laying strain) commence to lay at from five to six months old, whereas one hatched after August will not lay till she is eight or nine months old.

All houses should be gone over thoroughly this month and made absolutely water-tight as regards sides, roof and floor; it is as well to fill in the last-mentioned to several inches above the surrounding ground. ram it tight and make it smooth and hard, for during the wet season all scratching litter should be put in the house and the birds scratch for their grain there.

See that some shade (very little is required) is provided for the birds during the hot weather, and, above all, that the houses are not hot and stuffy at night, but that ample fresh air without draughts has access.

Turkey hatching should now cease till after the rainy season has finished. Do not try to encourage turkeys to lay during this time; let them all run free in the bush.

Continue hatching ducklings. These thrive during the wet weather as well, if not better, than during the dry, provided they *always* have warm, dry sleeping quarters.

## STOCK.

*Cattle.*—Ranching cattle on granite veld will in many instances be in fairly good condition on account of the early grass in the vleis, etc. On the diorite soils and later veld the cattle owner will still have to watch his weaker cattle carefully. In any case all supplies of hay, ensilage, majordas, etc., should be carefully husbanded in anticipation of possible late rains, but at the same time every effort should be made to prevent cattle becoming weak. Dairymen will need to feed highly both with succulents and green foods. Calves should be weaned and branded, if this has not already been done, and care should be taken that they do not suffer any serious set-back by reason of the want of veld. If calves are not desired in mid-winter, the bulls should be taken out of the herd now until the end of January. Care should be taken to provide a plentiful supply of clean water, and dipping must be regularly attended to.

*Sheep.*—If spring lambs are expected, one should see that the sheep shed is in order, and that there is a supply of hay, ensilage or mealies for the poorer ewes in the case of late rains. All drinking places should be cleaned out, and care taken that the water supply is sufficient.

## VETERINARY.

White scour is prevalent in spring—November and December—but dipping is eradicating this disease. There is still danger from vegetable poisoning, and it will only disappear when there is plenty of good grass on the veld.

## WEATHER.

This is apt to be a hot dry month, and rather trying, therefore, to man and beast, and the strong winds which blow at this season add to the general discomfort. Evaporation is, as a consequence, at its greatest at this time of year, and dams and pools lose most from this cause. The prevalence of veld

fires at this time of year adds to the anxiety of the stock owner. The average rainfall in Mashonaland is from one to one-and-three-quarters of an inch; in Matabeleland one inch or so, and rather less in the Zambesi Valley. Generally speaking, the rain is more plentiful and earlier in the eastern districts, and takes the form of thunder showers at this time of year.

The rainy season has occasionally started early in October, but for practical purposes it need not be expected before the end of this month. The days are becoming warmer, and often even hot and oppressive. Clouds gradually collect, at first disappearing at sunset, but later becoming more persistent. Sheet lightning is usually frequent, and showers of gradually-increasing severity mark that the rainy season has set in. Steps should be taken in advance to provide for the run-off after such torrential rains, otherwise serious loss may result.

## November.

### BEE KEEPING.

Now that the first honey flow is on, be sure the hives stand level, whether working them for extracted or section honey. This is important, saving annoyance when preparing the product for market. Occasionally, where bees have not been thoroughly subdued, they object to the removal of honey; postpone the operation for 24 hours. Where increase of stocks is required, artificial swarms can now be made. Use care in storing honey.

### CITRUS FRUITS.

If no appreciable rain has fallen, irrigation must still be resorted to, in order to keep the trees in good growth and not allow any check to the fruit. This is the best month to sow beans or other seeds for ploughing in later as green manure. Sow about 75 lbs. of kaffir beans per acre, so as to cover the whole area with a green covering.

### CROPS.

This month is one of the busiest on the farm. Planters, cultivators, etc., should be examined and put into order. A great many of the misses in the maize field are undoubtedly due to faulty planting. All seeds should be overhauled, and ground nuts intended for seed are best shelled immediately before planting. Planting and sowing will commence with the rains. Among the first crops to be sown are maize, velvet beans (for seed), ground nuts, dhal and sunflower. Napier fodder roots may be divided if the rains will allow of transplanting.

### ENTOMOLOGICAL.

*Maize.*—Crops planted before the last week in this month are very liable to suffer later from stalk borer. Wherever practicable postpone planting until December. See "Maize Stalk Borer," *Agricultural Journal*, December, 1917. Red lands may be baited at the end of the month against surface beetles, snout beetles and other pests which reduce the primary stand of plants. See "Maize Culture on Red Soils," "Value of Poisoned Bait as an Aid to Good Stands," *Agricultural Journal*, April, 1919. Cutworms are not likely to attack the crop badly on red soil until December, but may be in evidence in vleis situations in November. See "Cutworms," *Agricultural Journal*, August, 1918. The black maize beetle will be in evidence on infested farms, but this pest has as yet been imperfectly studied. See "The Maize Beetle," *Agricultural Journal*, February, 1918.

*Tobacco.*—Practically all the enemies of this crop are apt to be injurious when it is newly planted out. See "Tobacco Pests of Rhodesia," *Agricultural Journal*, February, 1920.

*Potato.*—The first brood of the leaf-eating ladybirds commences in November. See "Two Ladybirds injurious to Potato," *Agricultural Journal*, October, 1913. Blue blister beetles are frequently a nuisance on sandy soils, and caterpillars may be troublesome. The potato tuber moth is apt to cause injury to the tops at this time of year. An arsenical spray, such as arsenate of lead or Paris green, can be used to check these pests.

*Cabbage, Turnip, etc.*—Diamond-back moth and webworm are the chief pests, though cabbage aphids may be in evidence (see under October). Liberal watering and washing the plants down regularly with a forceful stream of water from a hose or spray pump helps considerably against the cabbage aphids.

*Beans and Peas.*—As under October.

*Cucumbers, Marrows, etc.*—As under October.

*Citrus Trees.*—As under October.

*Deciduous Fruit Trees.*—Chafer beetles may still be injurious (see under October). Choice varieties of early peaches may be netted as a protection against fruit-piercing moths.

*Figs.*—As under October.

### FLOWER GARDEN.

All seeds may now be planted. Annuals for January flowering should be sown, amongst which the following will be found to do excellently in this country:—Balsam, Calliopsis, Centurias, Chrysanthemum, Dianthus, Escholtzia, Marigold, Mignonette, Gallardia, Phlox, Poppy, Nasturtium, Nigella, Verbena and Zinnia. These are all hardy, and may be sown in the open either in beds or in the position desired for flowering. Advantage should be taken of each shower of rain during this month to keep the soil well worked and loose.

### VEGETABLE GARDEN.

All vegetable seeds may be sown during this month. Tomatoes and early peas and beans should be staked. The soil should be kept loose and free from weeds, which now get troublesome. Sow pumpkin, mealies, peas and potatoes.

### FORESTRY.

Any young plants that are still in the beds should be pricked out into tins in the early part of this month. It is really rather late for this work. If the cross-ploughing and harrowing were not tackled last month, it should be done now.

### POULTRY.

Some of the birds will soon commence to moult; some may be doing so already. It is most unprofitable to allow these to take weeks to get through it, or, in poultry parlance, "hang in the moult." Immediately a bird is noticed commencing to drop its feathers it should be placed in another house and run, and fed well. In addition to their ordinary food, these birds should be given, once a day, a mixture of stewed linseed and mealie meal or bran. A dessertspoonful of linseed should be stewed gently in one pint of water, and then mixed with enough mealie meal or bran to make a crumbly food; also to these birds should be given a little morn meat or milk than they were formerly getting. To get them through the moult quickly of course means more eggs.

During this and next month diseases of the respiratory and alimentary systems are more prevalent, due to bad housing and sour food, therefore it is necessary to take precautions to prevent these. Coccidiosis, too, is a disease which is more prevalent during the rainy season; again prevention is better than cure, and it is as well to put powdered catechu in the drinking water (half a thimbleful to a quart of water) once or twice a week, especially if birds are known to be dying in the district.

Cockerels destined for the Christmas market should be shut up, fed well and not allowed to take much exercise. An extra feed of soft wet mash (but not sloppy) consisting of mealie meal and milk should be given daily; the additional 2, 3 or 4 lbs. of weight they will put on with this treatment will help them to sell better on the markets.

Do not pen up turkeys for the Christmas market till a week before despatching, but feed well during this time. A turkey, if penned up too long, pines and loses its appetite and flesh. When selecting for the Christmas markets, get rid of (in addition to the cockerels) the poor layers and lazy birds. Keep nothing that is unprofitable in the poultry line on the farm.

### STOCK.

*Cattle.*—Normally rains should have fallen and the veld should be plentiful now. Beyond careful dipping, ranchers should not have much worry. If the season is bad, the poorer cattle should be drafted out and given a little hay, ensilage or mealies daily. Dairymen will not require to feed much succulent food, and usually the more expensive protein foods may be considerably curtailed at this time, but good sweet hay and mealies will be found to be very beneficial to milch cows, even if the veld is very plentiful. Clean dry sleeping places for both cows and calves will pay handsomely for any extra trouble involved. Young calves do not need to walk far, and in wet weather are much best in a clean dry pen. Watch for ticks.

*Sheep.*—Keep the sheep on high dry land. Be careful to keep the ticks down. Be sure the kraal or sheep shed is dry and clean, and that there is shelter from the rain for young lambs.

### TOBACCO.

Continue to sow seed beds, watering, etc. When early beds become overgrown and hard, pull out, dig up and re-sow. Begin transplanting with the first good rains, and continue as fast as the rains and planters will allow, until the crop is set out.

Be careful to fill in the misses from previous transplanting before starting on new fields; use the stoutest and best plants for filling in, and try to get the tobacco from any one field to grow and come to maturity as near at the same time as possible. Discontinue filling in when the field has been planted for several weeks, and has made a good start to grow, as the later filled in plants will be choked out by the earlier ones, and will not come to maturity.

### VETERINARY.

Early heavy rains might bring on horse-sickness before its usual time, but as a rule it need not be feared till the first rains are over in December.

### WEATHER.

The rains should be commencing, if not already begun; occasionally they have delayed until December, and even later, before setting in properly. Between spells of wet weather lasting several days, fine dry periods occur, at first clear, but later cloudy and thundery, gradually gathering to burst in thunder storms. The mornings are generally fine, and rain falls chiefly in the afternoon or evening. Heavy down pours are to be expected, and should be provided against beforehand by means of ditches and embankments, and by clearing water ways and furrows.

In an ordinary season the rainfall is from four to five inches, more in the east and less in the west and in our two great river valleys of the Zambesi and Limpopo. Before the rains commence, severe heat, trying on account of the strong winds and the dryness of the air, is likely to be experienced.

## Southern Rhodesia Weather Bureau.

JULY AND AUGUST, 1923.

**Pressure.**—During the month of July the mean barometric pressure was below normal over the whole country, and varied from 0.03 in. below normal at Bulawayo to 0.04 in. below normal at Salisbury. The fluctuations in the barometric pressure during the month were large, the maximum range varying from 0.22 in. at Bulawayo to 0.17 in. at Salisbury. High pressure areas were present only on the 16th to 18th and 29th to 31st; the maximum high on the 30th was 0.09 in. above normal at Bulawayo and 0.06 in. above normal at Salisbury. Low pressure areas were present during the major portion of the month, the minimum low on the 5th being 0.11 in. below normal at Salisbury and 0.13 in. below normal at Bulawayo.

During the month of August the mean barometric pressure was above normal over the whole country, and varied from 0.03 in. above normal at Gwelo and Bulawayo to normal at Salisbury. The fluctuations in the barometric pressure during the month varied from a maximum range of 0.20 in. at Bulawayo to 0.14 in. at Salisbury. High pressure areas were present from the 4th to 16th, 20th to 22nd and 29th to 31st, the maximum high being 0.11 in. above normal at Bulawayo on 7th and 0.05 in. above normal at Salisbury on the 8th. The minimum low on the 18th was 0.09 in. below normal at both Bulawayo and Salisbury.

**Temperature.**—During July the mean temperature was above normal over the major portion of the country, and varied from 1.8° F. above normal at Gwelo to normal at Salisbury. The mean daily temperature varied from 2.8° F. above normal at Salisbury to 2.3° F. below normal at Umtali; whilst the mean night temperatures varied from 4.3° F. above normal at Umtali to 2.8° F. below normal at Salisbury. Frosts were generally light and the prevailing weather cloudier than usual.

During August the mean temperature was slightly below normal over the bulk of the country, and varied from 0.4° F. above normal at Bulawayo to 0.3° F. below normal at Gwelo. The mean daily temperature varied from 1.8° F. above normal at Gwelo to 2.7° F. below normal at Umtali; whilst the mean night temperatures varied from 2.3° F. above normal at Umtali to 2.3° F. below normal at Gwelo.



**Rainfall.**—During the period 7th to 11th July rain was recorded at a number of stations in Mashonaland, more particularly in the northern portion of the country. The rain was associated with thunder and lightning storms, a most unusual occurrence at this time of the year, and reported as only previously experienced in 1911. During the period 13th to 16th August light scattered showers were experienced at a number of places in Mashonaland. The prevailing weather characteristics of these two months were humidity above normal, cloudier than usual, frosts light and showers more general than the normal.

**Wind Direction.**—The mean wind direction at Salisbury during the month of July was N. 63° E., and the prevailing wind direction was from the north-east, 48.1 per cent. of the total mileage for the month being from that direction. The mean wind direction at Salisbury during the month of August was N. 81° E., and the prevailing wind direction was from the east, 40.1 per cent. of the total mileage being from that direction. The mean and prevailing wind directions for these months during the last three years are as follows:—

| Month.       | Mean Wind Direction. | Prevailing Wind Direction and Percentage. |
|--------------|----------------------|-------------------------------------------|
| 1921. July   | S. 86° E.            | E. 31.2 per cent.                         |
| 1922. July   | N. 82° E.            | E. 35.2 „                                 |
| 1923. July   | N. 63° E.            | N.E. 48.1 „                               |
| 1921. August | S. 87° E.            | E. 33.1 „                                 |
| 1922. August | N. 53° E.            | N.E. 60.5 „                               |
| 1923. August | N. 81° E.            | E. 40.1 „                                 |

## RAINFALL.

| STATION.              | 1923. |         | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|-----------------------|-------|---------|-------------------------------|--------------------------------------------|
|                       | July. | August. |                               |                                            |
| ZONE A.:              |       |         |                               |                                            |
| Bubi—                 |       |         |                               |                                            |
| Glenmartin Estate ... | —     | —       | —                             | n.s.                                       |
| Imbesu Kraal ...      | 0.15  | —       | 0.15                          | 0.02                                       |
| Inyati ...            | —     | —       | —                             | 0.06                                       |
| Maria Farm ...        | 0.02  | —       | 0.02                          | n.s.                                       |
| Maxim Hill ...        | —     | —       | —                             | 0.04                                       |
| Shangani Estate ...   | —     | —       | —                             | —                                          |
| Bulalima—             |       |         |                               |                                            |
| Kalaka ...            | —     | —       | —                             | —                                          |
| Riverbank ...         | —     | —       | —                             | —                                          |
| Solusi Mission ...    | —     | —       | —                             | 0.02                                       |
| Bulawayo—             |       |         |                               |                                            |
| Fairview Farm ...     | —     | —       | —                             | 0.01                                       |
| Keendale ...          | 0.07  | —       | 0.07                          | 0.04                                       |
| Lower Rangemore ...   | 0.05  | —       | 0.05                          | 0.02                                       |
| Observatory ...       | —     | —       | —                             | 0.08                                       |
| Umgusa ...            | —     | —       | —                             | —                                          |
| Gwelo—                |       |         |                               |                                            |
| Dawn ...              | —     | —       | —                             | —                                          |
| Gwelo Gaol ...        | —     | —       | —                             | 0.12                                       |
| Riversdale Estate ... | —     | —       | —                             | —                                          |
| Somerset Estate ...   | —     | —       | —                             | 0.02                                       |
| Insiza—               |       |         |                               |                                            |
| Orangedale ...        | —     | —       | —                             | 0.10                                       |
| Thornville ...        | —     | —       | —                             | 0.03                                       |
| Nyamandhlovu—         |       |         |                               |                                            |
| Gwaai Reserve ...     | —     | —       | —                             | n.s.                                       |
| Impondeni ...         | —     | —       | —                             | —                                          |
| Naseby ...            | —     | —       | —                             | —                                          |
| Paddy's Valley ...    | —     | —       | —                             | n.s.                                       |
| Wankie—               |       |         |                               |                                            |
| Lynwood ...           | —     | —       | —                             | —                                          |
| Waterford ...         | —     | —       | —                             | n.s.                                       |
| Wankie Hospital ...   | —     | —       | —                             | 0.02                                       |
| Sebungwe—             |       |         |                               |                                            |
| Gokwe ...             | —     | —       | —                             | 0.01                                       |
| ZONE B.:              |       |         |                               |                                            |
| Belingwe—             |       |         |                               |                                            |
| Belingwe (N.C.) ...   | —     | —       | —                             | n.s.                                       |
| Bickwell ...          | —     | —       | —                             | —                                          |
| Bubje Ranch ...       | —     | —       | —                             | n.s.                                       |
| Bulalima—             |       |         |                               |                                            |
| Edwinton ...          | —     | —       | —                             | 0.07                                       |
| Garth ...             | —     | —       | —                             | 0.15                                       |
| Maholi ...            | —     | —       | —                             | —                                          |
| Retreat ...           | —     | —       | —                             | 0.04                                       |
| San Iown ...          | —     | —       | —                             | n.s.                                       |
| Tjompanie ...         | —     | —       | —                             | 0.01                                       |

## RAINFALL—(Continued).

| STATION.                      | 1923. |         | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|-------------------------------|-------|---------|-------------------------------|--------------------------------------------|
|                               | July. | August. |                               |                                            |
| ZONE B.—(Continued)           |       |         |                               |                                            |
| Gwanda—                       |       |         |                               |                                            |
| Gwanda Gaol ... ..            | —     | —       | —                             | 0.12                                       |
| Limpopo ... ..                | —     | —       | —                             | n.s.                                       |
| Tuli ... ..                   | —     | —       | —                             | 0.11                                       |
| Insiza—                       |       |         |                               |                                            |
| Albany ... ..                 | 0.07  | —       | 0.07                          | 0.01                                       |
| Filabusi ... ..               | —     | —       | —                             | 0.14                                       |
| Fort Rixon ... ..             | —     | —       | —                             | 0.04                                       |
| Infiningwe ... ..             | 0.16  | —       | 0.16                          | 0.09                                       |
| Lancaster ... ..              | —     | —       | —                             | n.s.                                       |
| Matobo—                       |       |         |                               |                                            |
| Holly's Hope ... ..           | —     | —       | —                             | 0.04                                       |
| Mtshabezi Mission ... ..      | —     | —       | —                             | 0.11                                       |
| Matopo Mission ... ..         | —     | —       | —                             | 0.13                                       |
| Rhodes Matopo Park ... ..     | —     | —       | —                             | —                                          |
| Umfula ... ..                 | 0.01  | —       | 0.01                          | n.s.                                       |
| Wenlock Ranch ... ..          | —     | —       | —                             | n.s.                                       |
| Umzingwane—                   |       |         |                               |                                            |
| Essexvale ... ..              | 0.07  | —       | 0.07                          | 0.03                                       |
| Kodhwayo ... ..               | —     | —       | —                             | n.s.                                       |
| ZONE C. :                     |       |         |                               |                                            |
| Charter—                      |       |         |                               |                                            |
| Bushy Park ... ..             | —     | —       | —                             | 0.02                                       |
| Enkeldoorn ... ..             | —     | —       | —                             | 0.12                                       |
| Marshbrook ... ..             | 0.15  | —       | 0.15                          | 0.02                                       |
| Range ... ..                  | 0.10  | —       | 0.10                          | 0.16                                       |
| Umnati ... ..                 | 0.03  | —       | 0.03                          | —                                          |
| Vrede ... ..                  | —     | —       | —                             | 0.04                                       |
| Ohilimanzi—                   |       |         |                               |                                            |
| Allanberry ... ..             | 0.23  | 0.10    | 0.33                          | 0.05                                       |
| Central Estates ... ..        | —     | 0.06    | 0.06                          | —                                          |
| Gwelo—                        |       |         |                               |                                            |
| Cross Roads ... ..            | —     | —       | —                             | 0.01                                       |
| East Clare Ranch ... ..       | 0.05  | —       | 0.05                          | n.s.                                       |
| Globe and Phoenix Mine ... .. | 0.12  | —       | 0.12                          | 0.04                                       |
| Indiva ... ..                 | —     | —       | —                             | n.s.                                       |
| Lyndene ... ..                | —     | —       | —                             | n.s.                                       |
| Rhodesdale Ranch ... ..       | —     | —       | —                             | —                                          |
| Hartley—                      |       |         |                               |                                            |
| Ardgowan ... ..               | —     | —       | —                             | 0.83                                       |
| Balwearie ... ..              | —     | —       | —                             | n.s.                                       |
| Beatrice... ..                | 0.04  | —       | 0.04                          | n.s.                                       |
| Carnock ... ..                | 0.21  | —       | 0.21                          | 0.08                                       |
| Cromdale ... ..               | 0.10  | —       | 0.10                          | n.s.                                       |
| Elvington ... ..              | 0.49  | —       | 0.49                          | 0.04                                       |
| Gatooma ... ..                | —     | —       | —                             | 0.03                                       |
| Gowerlands ... ..             | —     | —       | —                             | 0.06                                       |
| Hallingbury ... ..            | —     | —       | —                             | 0.04                                       |
| Hartley Gaol ... ..           | —     | —       | —                             | 0.04                                       |
| Hopewell ... ..               | —     | —       | —                             | —                                          |

## RAINFALL—(Continued).

| STATION.                        | 1923. |         | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|---------------------------------|-------|---------|-------------------------------|--------------------------------------------|
|                                 | July. | August. |                               |                                            |
| ZONE C.—(Continued)             |       |         |                               |                                            |
| Hartley (Continued)—            |       |         |                               |                                            |
| Jenkinstown ...                 | —     | —       | —                             | 0.03                                       |
| Philippaugh ...                 | —     | —       | —                             | 0.10                                       |
| Ranwick ...                     | —     | —       | —                             | —                                          |
| Spitzkop ...                    | —     | —       | —                             | 0.05                                       |
| Lomagundi—                      |       |         |                               |                                            |
| Argyle ...                      | 1.54  | —       | 1.54                          | 0.08                                       |
| Baguta ...                      | —     | —       | —                             | 0.05                                       |
| Citrus Estate ...               | —     | —       | —                             | 0.11                                       |
| Darwendale ...                  | —     | —       | —                             | 0.03                                       |
| Dingley Dell ...                | —     | —       | —                             | n.s.                                       |
| Feira ...                       | —     | —       | —                             | n.s.                                       |
| Freda ...                       | —     | —       | —                             | n.s.                                       |
| Gambuli ...                     | —     | —       | —                             | 0.16                                       |
| Gungurubee ...                  | —     | —       | —                             | n.s.                                       |
| Impingi ...                     | —     | —       | —                             | n.s.                                       |
| Mafoota ...                     | 0.32  | 0.07    | 0.39                          | n.s.                                       |
| Maningwa ...                    | —     | —       | —                             | 0.08                                       |
| Mica Field ...                  | 0.02  | 0.12    | 0.14                          | n.s.                                       |
| Mpandegutu ...                  | —     | —       | —                             | n.s.                                       |
| Mukwe River Ranch ...           | 0.50  | —       | 0.50                          | —                                          |
| Nyapi ...                       | 0.01  | —       | 0.01                          | n.s.                                       |
| Nyaroro ...                     | —     | —       | —                             | n.s.                                       |
| Nyati ...                       | —     | —       | —                             | n.s.                                       |
| Palm Tree Farm ...              | 0.45  | —       | 0.45                          | —                                          |
| Richmond ...                    | —     | —       | —                             | n.s.                                       |
| Romsey ...                      | 0.06  | —       | 0.06                          | n.s.                                       |
| Sangwe ...                      | —     | —       | —                             | n.s.                                       |
| Silater Estate ...              | 0.18  | —       | 0.18                          | n.s.                                       |
| Sinoia ...                      | —     | 0.02    | 0.02                          | 0.04                                       |
| Sipolilo ...                    | 0.37  | —       | 0.37                          | —                                          |
| Talfourd ...                    | 0.38  | 0.03    | 0.41                          | 0.02                                       |
| Umboe ...                       | —     | —       | —                             | n.s.                                       |
| Umvukwe Ranch ...               | 0.15  | —       | 0.15                          | —                                          |
| Woodleigh ...                   | 0.02  | —       | 0.02                          | n.s.                                       |
| Salisbury—                      |       |         |                               |                                            |
| Avondale ...                    | 0.42  | —       | 0.42                          | 0.13                                       |
| Botanical Experiment Station... | 0.03  | —       | 0.03                          | 0.01                                       |
| Bromley ...                     | 0.31  | 0.04    | 0.35                          | 0.23                                       |
| Cleveland Dam ...               | 0.07  | —       | 0.07                          | 0.10                                       |
| Gwebi ...                       | 0.11  | —       | 0.11                          | 0.03                                       |
| Hillside ...                    | 0.04  | 0.22    | 0.26                          | 0.13                                       |
| Lilfordia ...                   | —     | —       | —                             | 0.04                                       |
| Lochinvar ...                   | —     | —       | —                             | n.s.                                       |
| Manor Farm ...                  | —     | —       | —                             | n.s.                                       |
| Salisbury Gaol ...              | —     | 0.16    | 0.16                          | 0.11                                       |
| Sebastopol ...                  | —     | —       | —                             | 0.11                                       |
| Selby ...                       | —     | —       | —                             | 0.03                                       |
| Stapleford ...                  | 0.15  | —       | 0.15                          | 0.11                                       |
| Tisbury ...                     | —     | 0.08    | 0.08                          | n.s.                                       |
| Vainona ...                     | 0.20  | 0.11    | 0.31                          | 0.09                                       |

## RAINFALL—(Continued).

| STATION.              | 1923. |         | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|-----------------------|-------|---------|-------------------------------|--------------------------------------------|
|                       | July. | August. |                               |                                            |
| ZONE C (Continued)    |       |         |                               |                                            |
| Sebungwe—             |       |         |                               |                                            |
| Sikombela ...         | —     | —       | —                             | 0.12                                       |
| Wolverley ...         | —     | —       | —                             | n.s.                                       |
| ZONE D. :             |       |         |                               |                                            |
| Darwin—               |       |         |                               |                                            |
| La Belle Esperance... | —     | —       | —                             | n.s.                                       |
| Mount Darwin ...      | —     | —       | —                             | 0.02                                       |
| Inyanga—              |       |         |                               |                                            |
| Carlow ...            | —     | —       | —                             | n.s.                                       |
| Inyanga ...           | 0.21  | 1.34    | 1.55                          | 0.15                                       |
| Juliasdale ...        | 0.53  | 1.61    | 2.14                          | n.s.                                       |
| Rhodes Estate ...     | 1.31  | 0.56    | 1.87                          | 0.27                                       |
| York ...              | 0.21  | —       | 0.21                          | 0.20                                       |
| Makoni—               |       |         |                               |                                            |
| Eagle's Nest ...      | 0.88  | 0.55    | 1.43                          | 0.19                                       |
| Forest Hill ...       | 0.10  | 0.32    | 0.42                          | 0.08                                       |
| Riversdale...         | 0.45  | —       | 0.45                          | n.s.                                       |
| Wensleydale ...       | 0.24  | 1.15    | 1.39                          | —                                          |
| Mazoe—                |       |         |                               |                                            |
| Atherstone ...        | —     | —       | —                             | n.s.                                       |
| Avonduur ...          | —     | —       | —                             | 0.06                                       |
| Benridge ...          | —     | —       | —                             | 0.01                                       |
| Bindura ...           | 0.12  | —       | 0.12                          | 0.02                                       |
| Ceres ...             | 0.45  | —       | 0.45                          | 0.05                                       |
| Chipoli ...           | —     | —       | —                             | —                                          |
| Citrus Estate ...     | 0.64  | 0.06    | 0.10                          | 0.11                                       |
| Craigengrower ...     | —     | —       | —                             | 0.05                                       |
| Glen Divis ...        | —     | —       | —                             | n.s.                                       |
| Great B... ..         | —     | —       | —                             | n.s.                                       |
| Kilmer ...            | —     | —       | —                             | 0.01                                       |
| Kingston ...          | 0.40  | 0.09    | 0.49                          | 0.03                                       |
| Mazoe ...             | —     | 0.03    | 0.03                          | —                                          |
| Marienzi ...          | 0.33  | 0.49    | 0.82                          | n.s.                                       |
| Marston...            | —     | —       | —                             | n.s.                                       |
| Mgutu ...             | —     | —       | —                             | —                                          |
| Omeath ...            | 0.16  | —       | 0.16                          | 0.03                                       |
| Pearson Settlement    | —     | —       | —                             | n.s.                                       |
| Ruia ...              | —     | —       | —                             | 0.12                                       |
| Ruoko Ranch ...       | 0.23  | —       | 0.23                          | 0.03                                       |
| Shamva ...            | —     | —       | —                             | —                                          |
| Stanley Kop ...       | 0.02  | 0.03    | 0.05                          | 0.07                                       |
| Sunnyside ...         | 0.06  | —       | 0.06                          | 0.05                                       |
| Teign ...             | —     | —       | —                             | 0.04                                       |
| Usk ...               | —     | —       | —                             | n.s.                                       |
| Virginia ...          | —     | —       | —                             | 0.01                                       |
| Via ...               | —     | —       | —                             | n.s.                                       |
| Woodlands ...         | 0.61  | 0.25    | 0.86                          | n.s.                                       |
| Zombi ...             | 0.37  | 0.77    | 1.14                          | 0.06                                       |

## RAINFALL—(Continued).

| STATION.                    | 1923. |         | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|-----------------------------|-------|---------|-------------------------------|--------------------------------------------|
|                             | July. | August. |                               |                                            |
| ZONE D.—(Continued)         |       |         |                               |                                            |
| Mrewa—                      |       |         |                               |                                            |
| Glen Somerset ...           | 0.16  | 0.15    | 0.31                          | 0.13                                       |
| Mrewa ...                   | 0.50  | 0.20    | 0.70                          | 0.08                                       |
| Selous Nek ...              | 0.18  | 0.18    | 0.36                          | 0.05                                       |
| Mtoko—                      |       |         |                               |                                            |
| Makaha ...                  | 0.22  | —       | 0.22                          | 0.03                                       |
| Mtoko ...                   | 0.31  | —       | 0.31                          | 0.03                                       |
| Salisbury—                  |       |         |                               |                                            |
| Arcturus ...                | 0.18  | —       | 0.18                          | n.s.                                       |
| Chindamora Reserve ...      | 0.13  | 0.04    | 0.17                          | n.s.                                       |
| Glenara ...                 | —     | —       | —                             | —                                          |
| Goromonzi ...               | 0.23  | —       | 0.23                          | 0.15                                       |
| Hatchliffe (Borrowdale) ... | —     | —       | —                             | 0.07                                       |
| Hillside (Bromley) ...      | —     | —       | —                             | n.s.                                       |
| Kilmuir ...                 | 0.12  | 0.43    | 0.55                          | n.s.                                       |
| Meadows ...                 | —     | —       | —                             | 0.14                                       |
| Springs ...                 | 0.22  | —       | 0.22                          | n.s.                                       |
| Vieta ...                   | —     | —       | —                             | n.s.                                       |
| ZONE E.:                    |       |         |                               |                                            |
| Belingwe—                   |       |         |                               |                                            |
| Belingwe ...                | —     | —       | —                             | —                                          |
| The Doro ...                | 0.15  | —       | 0.15                          | n.s.                                       |
| Shabani ...                 | —     | —       | —                             | n.s.                                       |
| Bikita—                     |       |         |                               |                                            |
| Angus Ranch ...             | —     | —       | —                             | n.s.                                       |
| Bikita ...                  | —     | 0.30    | 0.30                          | 1.07                                       |
| Devuli Ranch ...            | —     | —       | —                             | n.s.                                       |
| Charter—                    |       |         |                               |                                            |
| Buhera ...                  | 1.25  | —       | 1.25                          | 0.27                                       |
| Riversdale ...              | —     | —       | —                             | 0.02                                       |
| Chibi—                      |       |         |                               |                                            |
| Chibi ...                   | —     | —       | —                             | 0.04                                       |
| Chilimanzi—                 |       |         |                               |                                            |
| Chilimanzi ...              | —     | —       | —                             | 0.17                                       |
| Driefontein ...             | —     | 0.08    | 0.08                          | 0.16                                       |
| Felixburg ...               | —     | —       | —                             | n.s.                                       |
| Grootfontein ...            | —     | —       | —                             | —                                          |
| Induna Farm ...             | —     | —       | —                             | 0.11                                       |
| Requeza Estate ...          | —     | —       | —                             | n.s.                                       |
| Guta—                       |       |         |                               |                                            |
| Guta ...                    | —     | —       | —                             | 0.20                                       |
| Glenary ...                 | 0.10  | 0.69    | 0.79                          | n.s.                                       |
| M'vimvi Ranch ...           | —     | —       | —                             | —                                          |
| Tel-el-Kebir ...            | 0.20  | 0.08    | 0.28                          | 0.19                                       |
| Gwelo—                      |       |         |                               |                                            |
| Lover's Walk ...            | —     | —       | —                             | —                                          |
| Oaklands ...                | 0.05  | —       | 0.05                          | 0.04                                       |
| Partridge Farm ...          | 0.02  | —       | 0.02                          | —                                          |
| Sheep Run Farm ...          | —     | —       | —                             | —                                          |

## RAINFALL—(Continued).

| STATION.                    | 1923. |         | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|-----------------------------|-------|---------|-------------------------------|--------------------------------------------|
|                             | July. | August. |                               |                                            |
| Zone E.—(Continued)         |       |         |                               |                                            |
| Insiza—                     |       |         |                               |                                            |
| Roodehouvel ...             | —     | —       | —                             | 0.04                                       |
| Inyanga—                    |       |         |                               |                                            |
| St. Trias' Hill ...         | 0.12  | 0.50    | 0.62                          | 0.28                                       |
| Makoni—                     |       |         |                               |                                            |
| Chitora... ..               | 0.26  | 0.18    | 0.44                          | 0.19                                       |
| Craigendoran ...            | 0.45  | 0.40    | 0.85                          | 0.22                                       |
| Gorubi Springs ...          | 0.24  | —       | 0.24                          | 0.21                                       |
| Mona ... ..                 | 0.39  | 0.15    | 0.54                          | 0.09                                       |
| Alonte Cassino ...          | 0.27  | 0.37    | 0.64                          | 0.22                                       |
| Rusape ... ..               | —     | —       | —                             | —                                          |
| Springs ... ..              | —     | —       | —                             | 0.18                                       |
| Marandellas—                |       |         |                               |                                            |
| Bonongwe ... ..             | —     | —       | —                             | 0.11                                       |
| Delta ... ..                | —     | —       | —                             | 0.23                                       |
| Igudu ... ..                | 0.10  | —       | 0.10                          | n.s.                                       |
| Land Settlement ...         | 0.35  | —       | 0.35                          | 0.11                                       |
| Lendy Estates ... ..        | —     | —       | —                             | —                                          |
| Marandellas ... ..          | —     | —       | —                             | 0.17                                       |
| Nelson ... ..               | —     | —       | —                             | 0.14                                       |
| Tweedjan ... ..             | —     | —       | —                             | 0.32                                       |
| White Gambolo Ranch ...     | 0.28  | 0.03    | 0.31                          | n.s.                                       |
| Melsetter—                  |       |         |                               |                                            |
| Brackenbury ... ..          | 0.50  | 1.31    | 1.81                          | 0.85                                       |
| Tom's Hope ... ..           | 0.15  | 0.88    | 1.03                          | 0.91                                       |
| Ndanga—                     |       |         |                               |                                            |
| Doornfontein ... ..         | 0.11  | —       | 0.11                          | 0.13                                       |
| Marah Ranch ... ..          | —     | —       | —                             | —                                          |
| Ndanga... ..                | —     | —       | —                             | 0.39                                       |
| Selukwe—                    |       |         |                               |                                            |
| Aberfoyle Ranch ... ..      | —     | —       | —                             | 0.09                                       |
| Hillingdon ... ..           | —     | —       | —                             | 0.09                                       |
| Impali Source ... ..        | 0.02  | —       | 0.02                          | n.s.                                       |
| Rio ... ..                  | —     | —       | —                             | 0.01                                       |
| Selukwe Gaol ... ..         | —     | —       | —                             | n.s.                                       |
| Umtali—                     |       |         |                               |                                            |
| Argyll ... ..               | 1.54  | —       | 1.54                          | 0.08                                       |
| Gilmerton ... ..            | 0.38  | 0.23    | 0.61                          | 0.07                                       |
| Jerain ... ..               | 0.07  | —       | 0.07                          | 0.43                                       |
| Mutambara Mission ...       | —     | —       | —                             | 0.16                                       |
| Odzani Power Station ...    | 0.34  | 0.59    | 0.93                          | 0.53                                       |
| Park Farm ... ..            | 0.67  | 0.43    | 1.10                          | n.s.                                       |
| Premier Estate ... ..       | 1.22  | 0.25    | 1.47                          | 0.17                                       |
| Sarum ... ..                | —     | —       | —                             | 0.06                                       |
| Stapleford ... ..           | 0.35  | 1.07    | 1.42                          | 0.11                                       |
| St. Augustine's Mission ... | 0.94  | 0.49    | 1.43                          | n.s.                                       |
| Umtali (Gaol) ... ..        | 0.57  | 0.28    | 0.85                          | 0.45                                       |
| Victoria—                   |       |         |                               |                                            |
| Brucehame ... ..            | 0.06  | —       | 0.06                          | 0.05                                       |
| Cambria ... ..              | —     | —       | —                             | n.s.                                       |
| Chevenden ... ..            | 0.16  | 0.14    | 0.30                          | n.s.                                       |

## RAINFALL—(Continued).

| STATION.              | 1923. |         | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|-----------------------|-------|---------|-------------------------------|--------------------------------------------|
|                       | July. | August. |                               |                                            |
| ZONE E.—(Continued)   |       |         |                               |                                            |
| Victoria (Continued)— |       |         |                               |                                            |
| Clipsham              | ...   | ...     | ...                           | 0.13                                       |
| Glenlivet             | ...   | 0.23    | 0.18                          | n.s.                                       |
| Gokomere              | ...   | 0.07    | 0.02                          | 0.18                                       |
| Histonhurst           | ...   | —       | —                             | —                                          |
| Makahori Farm         | ...   | —       | —                             | n.s.                                       |
| Makorsi River Ranch   | ...   | 0.10    | —                             | 0.16                                       |
| Mashaba               | ...   | —       | —                             | n.s.                                       |
| Morgenster Mission    | ...   | 0.17    | 0.30                          | 0.47                                       |
| M'Sali                | ...   | —       | —                             | n.s.                                       |
| Riverdene North       | ...   | 0.09    | —                             | 0.16                                       |
| Salemore              | ...   | 0.14    | —                             | n.s.                                       |
| Silver Oaks           | ...   | 0.11    | —                             | 0.11                                       |
| Stanmore              | ...   | 0.19    | —                             | 0.06                                       |
| Summerton             | ...   | —       | —                             | —                                          |
| Tewkesbury            | ...   | —       | —                             | n.s.                                       |
| Tichidza              | ...   | 0.25    | 0.20                          | 0.45                                       |
| Victoria              | ...   | 0.11    | —                             | 0.18                                       |
| Zimbabwe              | ...   | 0.13    | —                             | n.s.                                       |
| ZONE F.:              |       |         |                               |                                            |
| Melsetter—            |       |         |                               |                                            |
| Chikore               | ...   | 0.05    | 0.06                          | 0.73                                       |
| Chipinga              | ...   | 0.06    | —                             | 1.16                                       |
| Melsetter             | ...   | —       | 0.10                          | 1.14                                       |
| Mount Selinda         | ...   | —       | —                             | 1.68                                       |
| Vermont               | ...   | 0.16    | —                             | 2.19                                       |
| Umtali—               |       |         |                               |                                            |
| Hoboken               | ...   | —       | —                             | 1.10                                       |

— means nil.

... means no return.





## RHODESIAN MILK RECORDS TO DATE.

| Name of cow.           | Breed.    | Commenced record. | Milk in lbs. Latest return. | Butter fat in lbs. Latest return. | Milk in lbs. to date. | Butter fat in lbs. to date. | Time from commencement of record. | Name and address of owner.            |
|------------------------|-----------|-------------------|-----------------------------|-----------------------------------|-----------------------|-----------------------------|-----------------------------------|---------------------------------------|
| Begonia                | Friesland | 19/9/22           | 526                         | 18.93                             | 13,405.1              | 452.07                      | 300 days                          | J. A. Baxter, Victoria St., Salisbury |
| Banjo                  | Shorthorn | 9/8/22            | 168                         | 8.25                              | 4,434.8               | 182.61                      | 336 do                            | C. G. Cooper, Chambrey, Essexvale     |
| Baby                   | do        | 4/10/22           | 126.7                       | 6.53                              | 3,118.2               | 146.53                      | 240 do                            | do do                                 |
| Pepper                 | do        | 1/11/22           | 288.8                       | 12.82                             | 3,617.6               | 166.59                      | 280 do                            | do do                                 |
| Zaza                   | do        | 8/12/22           | 163.4                       | 9.77                              | 2,905.3               | 158.7                       | 245 do                            | do do                                 |
| Ann                    | do        | 26/12/22          | 165.9                       | 7.3                               | 2,264.5               | 115.08                      | 217 do                            | do do                                 |
| Mary                   | do        | 14/3/23           | 308.7                       | 11.73                             | 2,130.8               | 89.37                       | 147 do                            | do do                                 |
| Betta                  | do        | 25/7/23           | 285.6                       | 9.8                               | 285.6                 | 9.8                         | 14 do                             | do do                                 |
| Sally                  | do        | 25/7/23           | 207.9                       | 9.96                              | 207.9                 | 9.96                        | 14 do                             | do do                                 |
| Rokkie                 | Friesland | 15/2/23           | 521.5                       | ...                               | 4,750.5               | ...                         | 198 do                            | W. P. Edwards, Westacre Junction      |
| Robbie                 | do        | 19/2/23           | 440.5                       | ...                               | 4,330.5               | ...                         | 194 do                            | do do                                 |
| Kolmuis                | do        | 23/3/23           | 542.5                       | ...                               | 3,763.5               | ...                         | 162 do                            | do do                                 |
| Trakkie                | do        | 24/4/23           | 499.5                       | ...                               | 2,466.5               | ...                         | 125 do                            | do do                                 |
| Wonderlik              | do        | 6/6/23            | 549                         | ...                               | 1,944                 | ...                         | 88 do                             | do do                                 |
| Knijptang              | do        | 13/7/23           | 666.5                       | ...                               | 1,299.5               | ...                         | 54 do                             | do do                                 |
| Zwartappel             | do        | 29/8/23           | 57                          | ...                               | 57                    | ...                         | 2 do                              | do do                                 |
| Mulder's Vlei Juno     | do        | 21/3/23           | 630                         | 22.68                             | 2,422                 | 90.44                       | 98 do                             | Knight & Folkstad, Lochinvale.        |
| Rivenhill Ceres Ormsby | do        | 4/4/23            | 805                         | 28.98                             | 1,919                 | 93.53                       | 81 do                             | Salisbury                             |
| Brakfontein Klaske II. | do        | 1/5/23            | 1,778                       | 56.796                            | 3,430                 | 119.572                     | 56 do                             | do do                                 |
| Lizzie                 | Cape Cow  | 4/5/23            | 770                         | 24.64                             | 1,482                 | 53.12                       | 53 do                             | do do                                 |
| Henrietta              | Shorthorn | 24/11/22          | 112                         | ...                               | 2,712.5               | ...                         | 280 do                            | R. C. MacLagan, Rusape                |

N.B.—A gallon of milk weighs approximately 10 lbs.

## RHODESIAN MILK RECORDS—continued.

| Name of cow.   | Breed.    | Commenced record. | Milk in lbs. Latest return. | Butter fat in lbs. Latest return. | Milk in lbs. to date. | Butter fat in lbs. to date. | Time from commencement of record. | Name and address of owner.         |
|----------------|-----------|-------------------|-----------------------------|-----------------------------------|-----------------------|-----------------------------|-----------------------------------|------------------------------------|
| Agnes          | Shorthorn | 1/12/22           | 133                         | ...                               | 1,699                 | ...                         | 232 days                          | R. C. MacLagan, Rasape             |
| Gladys         | Ayrshire  | 2/2/23            | 227.5                       | ...                               | 2,268                 | ...                         | 210 do                            | do do                              |
| Lizzie         | do        | 11/5/23           | 129.5                       | ...                               | 671                   | ...                         | 112 do                            | do do                              |
| Rinske VIII... | Friesland | 17/8/23           | 487                         | ...                               | 487                   | ...                         | 15 do                             | E. Remiker, Salisbury              |
| Rosebud        | do        | 17/9/22           | 332                         | 18.26                             | 4,740                 | 240.91                      | 343 do                            | do do                              |
| Cherry Blossom | do        | 27/11/22          | 447                         | 23.24                             | 5,843                 | 302.77                      | 273 do                            | J. S. Struthers, Palm Tree, Simnia |
| Lucy           | do        | 10/12/22          | 378                         | 18.9                              | 4,910                 | 247.3                       | 239 do                            | do do                              |
| Moffie         | do        | 17/12/22          | 437                         | 17.48                             | 4,968                 | 200.13                      | 232 do                            | do do                              |
| P. T. Peach    | do        | 7/1/23            | 420                         | 16.8                              | 4,898                 | 193.23                      | 231 do                            | do do                              |
| P. T. Lady     | do        | 7/1/23            | 381                         | 16                                | 3,994                 | 169.99                      | 231 do                            | do do                              |
| Corral         | do        | 4/3/23            | 994                         | 49.7                              | 5,170                 | 300.85                      | 175 do                            | do do                              |
| Granny         | do        | 25/3/23           | 658                         | 28.62                             | 3,931                 | 178.8                       | 164 do                            | do do                              |
| Buttercup      | do        | 28/1/23           | 938                         | ...                               | 938                   | ...                         | 35 do                             | R. R. Sharp, Whinburn, Redbank     |

## Departmental Notices.

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The full series of notices usually published under this head no longer appears, and will be omitted in future. New notices and amendments of old ones will be published from time to time. The departmental announcements with which our readers are familiar, nevertheless, remain in force as before. The services of the officers of the Department are always available, whether it be for replying to enquiries or by personal visits to farms or by lectures to associations. Full particulars can be obtained from the Director of Agriculture, Salisbury, in reference to any of the subjects previously dealt with in these pages, such as supply of seeds and trees, co-operative seed distribution, insect pests, chemical analyses, and technical advice on veterinary matters, irrigation, citrus culture, poisonous plants and plant identification, examination of soils, dips, products, etc.; and generally on all questions relating to live stock and to tillage operations.

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### **BOTANICAL SPECIMENS FOR IDENTIFICATION.**

In all cases where a botanical identification is required it is of the utmost importance that the specimens reach the Department of Agriculture in a thoroughly dry condition, free from mildew, and intact, that is not broken in pieces. Whenever possible specimens should comprise main stem or small branch, leaves, flowers, seed vessels and roots or bulbs, though these need not necessarily be on the same plant.

The colour of the flowers and the general form of the plant should be preserved by pressing and drying between two sheets of blotting paper or newspaper. Ordinary plants not excessively succulent can be dried sufficiently in three days, provided the drying papers are changed every day. A heavy weight should be placed on the specimens in order to press them flat.

Correspondents are asked to supply the following particulars as far as possible:—

- (a) height and general appearance of plant or tree;
- (b) class of soil on which found;
- (c) locality and altitude;
- (d) supposed use or properties.

It is advised that specimens be packed between two sheets of cardboard or thin wood, since in this way they will travel long distances without fear of injury.

## DISTRIBUTION OF SEED FOR CO-OPERATIVE EXPERIMENTS.

It is anticipated that seed of the following summer crops will be available for free distribution under the usual terms of co-operative experiments from 1st August to 31st October. After the latter date no further applications for seed of summer crops can be entertained.

The seed is issued free, but the recipient is required to defray all forwarding and railway charges. Sufficient seed of each kind to sow one-quarter to one-half acre is supplied, and not more than three varieties can be sent to each applicant.

All applications should be addressed to the Chief Agriculturist, Department of Agriculture, Salisbury.

*Summer Oats.*—Sixty-day or Kherson.

*Oil Seeds.*—Linseed, sunflower, Spanish bunch ground nuts.

*Legumes.*—White stingless velvet beans, dolichos beans, Sunn hemp, dhal, lupins (for green manure), kudzu vine. Limited quantity of *Stizolobium taborense* (a new velvet bean).

*Hay Crops.*—Teff, Sudan grass, Boer manna, red manna.

*Pasture Grasses.*—Kikuyu, African star, swamp couch, Rhodesian tussock, as referred to in the *Rhodesia Agricultural Journal*, April 1923.

*Miscellaneous Crops.*—Buckwheat, Niger oil (for green manuring) and sweet potato runners.

## TREE PLANTING, 1923-24.

Will planters of 5,000 trees and over please notify their requirements, as far as they are able, for the planting season 1923-24 to the Manager, Forest Nursery, Salisbury?

This will facilitate work in the Nursery, and, by the booking of orders, will ensure the earliest possible attention.

## FARM SEEDS FOR SALE.

The undermentioned seeds grown on the Government experiment farms are offered for sale at the prices quoted. The quantities available are limited. Prices are f.o.r., Salisbury, or f.o.r., the Gwebi experiment farm. Owing to limited supply, the full delivery of any order cannot be guaranteed. Farmers are therefore requested not to enclose cheques until they are advised as to the amount of seed allotted to them. The seed is consigned carriage forward in the case of stations. In the case of sidings, the cost of railage will be notified after despatch. All applications for seed should be addressed to the Chief Agriculturist, Department of Agriculture.

- Hickory King, selected, hand-picked—20s. per 100 lbs.  
Salisbury White, selected, hand-picked—20s. per 100 lbs.  
Sunflower. Black Russian, from selected heads—15s. per 100 lbs.  
Linseed, white-flowered—6d. per lb.  
Niger oil—3d. per lb.  
Sunn hemp—3d. per lb.  
Teff grass—6d. per lb.  
Boer manna—4d. per lb.  
Pumpkins—2s. per lb.  
Oats, Kherson, sixty-day—30s. per 100 lbs.  
Sweet potato slips—5s. per sack (approximately 1,000 slips).  
Dolichos beans—25s. per 100 lbs.

## Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

### AGRICULTURE AND CROPS.

- No. 174. Notes on Hop Growing, by H. G. Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 218. Useful Measurements for Maize, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops. 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 327. Linseed, by C. Mainwaring.
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Virgin Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- No. 394. The Interdependence of Crop Rotation and Mixed Farming, by H. G. Mundy, F.L.S.
- No. 397. The Advantage of Autumn and Early Winter Ploughing, by C. Mainwaring.
- No. 399. Green Manuring and Soil Management, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 403. Florida Beggar Weed, by H. G. Mundy, F.L.S.
- No. 407. Wheat—Extracts from Bulletin No. 22, Victoria, Australia.
- No. 408. The Velvet Bean, by J. A. T. Walters, B.A.
- No. 416. Grasses of Agricultural Importance in Southern Rhodesia, by H. G. Mundy, F.L.S., G. N. Blackshaw, O.B.E., B.Sc., F.I.C., and E. V. Flack.

- No. 417. The Ground Nut or Monkey Nut, by C. Mainwaring.  
 No. 422. Improvement of Rhodesian White Maize by Selection, by C. Mainwaring.  
 No. 423. The Common Sunflower, by C. Mainwaring.  
 No. 428. The Sweet Potato, by J. A. T. Walters, B.A.  
 No. 429. Propagation of Kudzu Vine, by H. C. Arnold.  
 No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.  
 No. 445. Production of Maize, by C. Mainwaring.  
 No. 454. The Growing of Potatoes in Southern Rhodesia, by C. Mainwaring.  
 No. 455. White *v.* Yellow Maize, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.  
 No. 456. Legumes in Southern Rhodesia, by J. A. T. Walters.  
 No. 462. Hay-making in Rhodesia, by C. Mainwaring.  
 No. 464. Ensilage, by J. A. T. Walters, B.A.  
 Botanical Specimens for Identification.

#### REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.  
 No. 189. The Manuring of Maize on the Government Experiment Farm, Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.  
 No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.  
 No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.  
 No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.  
 No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.  
 No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.  
 No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.  
 No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.  
 No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.  
 No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.  
 No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.  
 No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.  
 No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.  
 No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-1920.  
 No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.  
 No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.  
 No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.  
 No. 432. Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S.  
 No. 433. Winter Cereal Experiments, 1921, by D. E. McLoughlin.  
 No. 437. Annual Report on Crop Experiments, Gwebi, 1921-22, by H. G. Mundy, F.L.S.  
 No. 440. Annual Report of Experiments, 1921-22, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.



## TOBACCO.

- No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.  
 No. 398. Wildfire and Angular Spot.  
 No. 404. Flue-Curing Tobacco Barns and Packing House (Second Revision),  
 by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.  
 No. 410. Common Mistakes in Growing and Handling Virginia Tobacco,  
 by H. W. Taylor, B.Agr.  
 No. 444. Tobacco Seed Beds, by H. W. Taylor, B.Agr.  
 No. 461. The Growing of Virginia Tobacco in Southern Rhodesia—  
 Field Operations, by H. W. Taylor, B.Agr.  
 Handbook of Tobacco Culture for Planters in Southern Rhodesia,  
 price 2s. 6d., post free outside South Africa 3s. 6d.

## STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by  
 Eric A. Nobbs, Ph.D., B.Sc.  
 No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.  
 No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season  
 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood.  
 No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D.,  
 B.Sc., and B. Haslewood, F.S.S.  
 No. 247. Statistical Returns of Crops grown by Europeans in Southern  
 Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D.,  
 B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S.,  
 Statistician.  
 No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A.  
 Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.  
 No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.  
 No. 286. Statistics of Live Stock and Animal Produce for the Year 1917,  
 by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.  
 No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and  
 F. Eyles, F.L.S.  
 No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles,  
 F.L.S.  
 No. 361. Statistics of Live Stock and Animal Produce for the Year 1919,  
 by F. Eyles, F.L.S.  
 No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia,  
 1919-1920, by H. C. K. Fynn.  
 No. 393. Statistics of Live Stock and Animal Produce for 1920, by  
 H. C. K. Fynn.  
 No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia  
 for the season 1920-21, by H. C. K. Fynn.  
 No. 426. Statistics of Live Stock and Animal Products for the year 1921,  
 by H. C. K. Fynn.  
 No. 443. Statistics of Crops Grown by Europeans in Southern Rhodesia  
 for the Season 1921-22, by F. Eyles, F.L.S., and H. C. K.  
 Fynn.  
 No. 459. Statistics of Live Stock and Animal Products for the Year 1922,  
 by A. Borradaile Bell.

## LIVE STOCK.

- No. 145. Prospects of Importation of Cattle from Australia, by E. A.  
 Nobbs, Ph.D., B.Sc.  
 No. 208. Water in the Diet of Live Stock, by L. E. W. Bevan, M.R.C.V.S.  
 No. 210. The Care and Feeding of Calves in Dairy and Stud Herds, by  
 R. C. Simmons.  
 No. 227. An Experiment in Beef Production, by R. C. Simmons.

- No. 245. Beef Feeding Experiment No. 2, by R. C. Simmons.
- No. 248. A Preservative for Samples of Arsenical Dips for Analysis, by A. G. Holborow, F.I.C., Assistant Government Agricultural Chemist.
- No. 250. Beef Feeding Experiment No. 3, by R. C. Simmons.
- No. 255. Pound Fees.
- No. 321. The Construction of Dipping Tanks for Cattle. Revised April, 1919.
- No. 336. Butchering and Flaying.
- No. 338. From Breeder to Butcher; Beef Feeding Experiment No. 5, by E. A. Nobbs, Ph.D., B.Sc.
- No. 340. Notes on Theory and Practice of Feeding Cattle in Southern Rhodesia, Part III., by R. C. Simmons.
- No. 345. Notes on the Theory and Practice of Feeding Cattle in Southern Rhodesia, Part IV., by R. C. Simmons.
- No. 381. From Breeder to Butcher; Cattle Feeding Experiment No. 8, by Eric A. Nobbs, Ph.D., B.Sc.
- No. 392. Memorandum on the Cattle Industry of Southern Rhodesia, 1921.
- No. 421. From Breeder to Butcher: Cattle Feeding Experiment No. 9, Government experiment farm, Gwebi, by E. A. Nobbs, Ph.D., B.Sc., F.H.A.S.
- No. 446. From Breeder to Butcher: Cattle Feeding Experiment No. 11, Government Experiment Farm, Gwebi, by Eric A. Nobbs, Ph.D., B.Sc., F.H.A.S.
- No. 448. The Cattle Industry.
- Arsenite Cattle Dip—How to Mix.

## DAIRYING.

- No. 277. A Farm Cheese and Butter Dairy, by R. C. Simmons and G. U. Fripp.
- No. 328. Pont l'Eveque Cheese, by J. B. Fisher, N.D.D.
- No. 329. Gervais Cheese, by J. B. Fisher, N.D.D.
- No. 356. Cream and its Production, by T. Hamilton.
- No. 370. Development of Flavour in Butter, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 383. Control of Temperature in Dairying, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 395. Farm Butter Making, by T. Hamilton, M.A., N.D.D., N.D.A.
- No. 401. Milk Records and Milk Testing, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 418. Manufacture of Cheddar Cheese, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 427. Common Defects in Butter-making, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 449. Farm Cheese-making, by T. Hamilton, M.A., N.D.A., N.D.D.
- No. 463. The Rearing of Bacon Pigs for Bacon Factory Purposes, by T. Hamilton, M.A., N.D.A., N.D.D.

## VETERINARY.

- No. 51. Strangles, by F. D. Ferguson, M.R.C.V.S.
- No. 121. Rabies, by L. E. W. Bevan, M.R.C.V.S., and T. G. Millington, M.R.C.V.S., D.V.H.
- No. 191. Scab or Scabies in Sheep and Goats, by Rowland Williams, M.R.C.V.S.
- No. 313. Obstruction in Sheath of Ox, by J. M. Sinclair, M.R.C.V.S.

- No. 316. Inoculation of Cattle against Redwater and Gall-sickness, by L. E. W. Bevan, M.R.C.V.S.  
 No. 352. African Coast Fever, by L. E. W. Bevan, M.R.C.V.S.  
 No. 364. Round-worm Infection of Calves, by H. E. Hornby, M.R.C.V.S.  
 No. 367. Quarter-evil, by C. R. Edmonds, M.R.C.V.S.  
 No. 431. History, Control and Treatment of Infectious Abortion in Cattle in Southern Rhodesia, by L. E. W. Bevan, M.R.C.V.S.  
 No. 435. A Short History of Infective Diseases, by J. M. Sinclair, M.R.C.V.S.  
 Services of Government Veterinary Surgeon

## IRRIGATION.

- No. 270. Odzani River Irrigation Scheme, by W. M. Watt.  
 No. 300. The Dangers and Prevention of Soil Erosion, by W. M. Watt.  
 No. 349. The Hydraulic Ram, by A. C. Jennings, A.M.Inst.C.E., A.M.I.E.E.  
 No. 376. Notes on the Water Law of Southern Rhodesia, by R. McIlwaine, M.A., LL.B.  
 No. 384. The Application of Water in Irrigation, by A. C. Jennings, Assoc.M.Inst.C.E., A.M.I.E.E.  
 No. 400. Soil Washing, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.  
 No. 412. Water Power Resources of Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.  
 No. 419. Irrigation Canals, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.  
 No. 438. Summer Irrigation in Rhodesia, by A. C. Jennings, A.M.Inst.C.E.  
 No. 452. Weirs and their Construction, by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.,  
 Engineering Advice.

## FORESTRY.

- No. 199. Eucalypts for the Farm, by J. J. Boocock.  
 No. 217. Windbreaks and Hedges, by F. B. Willoughby.  
 No. 236. Notes on Propagation by means of Cuttings in Rhodesia.  
 No. 315. Descriptive List of Forest Trees and Ornamental Shrubs.  
 No. 366. The Management of Woods, by J. S. Henkel.  
 No. 386. Forestry in Rhodesia: Improvement Fellings on the Farm, by J. S. Henkel.  
 No. 439. Forestry in Rhodesia: Planting and Care of Forest Trees, by J. S. Henkel.  
 No. 457. The Planting and Care of Hedges, by J. S. Henkel.  
 Price List of Forest Tree Transplants, Ornamental Shrubs, Hedge Plants and Seeds.

## HORTICULTURE.

- No. 354. The Home Orchard, by A. G. Turner.  
 No. 424. Citrus Fruit Growing in Rhodesia, by A. G. Turner.

## ENTOMOLOGY AND VEGETABLE PATHOLOGY.

- No. 139. Termites, or "White Ants," by Rupert W. Jack, F.E.S.  
 No. 171. The Cabbage Web-Worm—A Pest of Cabbage and Allied Plants, by R. W. Jack, F.E.S.

- No. 172. Diseases of the Potato Tuber and the Selection of Sound Seed, by Rupert W. Jack, F.E.S.  
 No. 178. Illustrations of Natural Forest in relation to Tsetse Fly, by R. W. Jack, F.E.S.  
 No. 187. The Dusty Surface Beetle, by Rupert W. Jack, F.E.S.  
 No. 197. Chafer Beetles, by R. W. Jack, F.E.S.  
 No. 204. Some Injurious Caterpillars, by R. W. Jack, F.E.S.  
 No. 214. Some Household Insects, by R. Lowe Thompson, B.A.  
 No. 219. More Household Insects, by R. Lowe Thompson, B.A.  
 No. 228. Rhodesian Citrus Pests, by R. W. Jack, F.E.S.  
 No. 233. Does it Pay to Spray Potatoes in Southern Rhodesia? by Rupert W. Jack, F.E.S.  
 No. 249. Home-made Fly Papers, by Rupert W. Jack, F.E.S., Government Entomologist.  
 No. 261. Turnip Sawfly, by R. W. Jack, F.E.S.  
 No. 276. The Maize Stalk Borer, by Rupert W. Jack, F.E.S.  
 No. 280. The Maize Beetle, by R. W. Jack, F.E.S.  
 No. 290. Notes on Remedies for Turnip Sawfly, by Rupert W. Jack, F.E.S.  
 No. 291. Cutworms, by Rupert W. Jack, F.E.S.  
 No. 302. A Note on the Maize Stalk Borer, by Rupert W. Jack, F.E.S.  
 No. 317. Maize Culture on Red Soil; Value of Poisoned Bait as an Aid to Good Stands, by Rupert W. Jack, F.E.S.  
 No. 353. Further Experiments with Poisoned Bait on Maize Lands, by R. W. Jack, F.E.S.  
 No. 369. The Bean Stem Weevil, by R. W. Jack, F.E.S.  
 No. 385. The Common Fruit Beetle, by R. W. Jack, F.E.S.  
 No. 402. Ticks Infesting Domestic Animals in Southern Rhodesia, by R. W. Jack, F.E.S.  
 No. 425. A Newly Recorded Pest of Maize: "Rootworm," by R. W. Jack, F.E.S.  
 No. 450. Insect Pests of Fruits other than Citrus in Southern Rhodesia, by R. W. Jack, F.E.S.  
 No. 460. Tsetse Fly: a Four Years' Experiment in Game Elimination, by R. W. Jack, F.E.S.

## POULTRY.

- No. 406. The Turkey, by A. Little.  
 No. 415. Mating for Improvement and Increased Egg Production, by A. Little.  
 No. 420. Poultry Husbandry: Housing and Feeding of Adult Fowls, by A. Little.  
 No. 434. Some Common Diseases of Poultry, by A. Little.  
 No. 441. Some Common Diseases of Poultry, by A. Little.  
 No. 451. Breeding for Increased Egg Production, by H. G. Wheeldon.  
 No. 458. Artificial Incubation, Brooding and Rearing of Chickens, by H. G. Wheeldon.  
 No. 465. The Poultry Industry: Parasites, by A. Little.

## METEOROLOGICAL.

- No. 436. The Possibility of Seasonal Forecasting and Prospects for Rain-fall Season 1922-23, by C. L. Robertson, B.Sc., A.M.I.C.E.

## MISCELLANEOUS.

- No. 93. Formation of Agricultural Credit Associations in Rhodesia, by Loudon M. Douglas, F.R.S.E.  
 No. 226. Classification of Clouds, by R. H. Scott, F.R.S.

- No. 254. Hints on Explosives, by W. M. Watt.
- No. 264. Nature Notes—Adaptation, by C. F. M. Swynnerton, F.L.S.
- No. 273. Enkeldoorn Produce Express Syndicate Rules.
- No. 274. Lecture on Malaria and Blackwater, by A. M. Fleming, C.M.G., M.B., C.M., F.R.C.S.E., D.P.H., Medical Director.
- No. 283. Maize Foods for the Home.
- No. 294. Directions for taking Samples for Analysis, by E. V. Flack, Acting Agricultural Chemist.
- No. 318. Notes on Mining Law for Farmers, by Advocate D. E. McCausland, M.A., LL.B.
- No. 358. Notes on the Regulations governing the Sale of Fertilisers and Farm Foods, by E. V. Flack.
- No. 360. Notes on the Rainfall Season 1919-20 in Southern Rhodesia, by C. L. Robertson, B.Sc., A.M.I.C.E.
- No. 391. Hints on Brickmaking, by G. T. Dyke.
- No. 414. Limestones in Southern Rhodesia, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 447. Composition and Fertilising Value of Wood Ash and other Ashes, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 453. The Manufacture of Roofing Tiles on the Farm, by Arthur J. Orner.
- The Analyses of Agricultural Products, Soils, Water, etc.
- Lectures for Farmers.
- Farming Returns for Income Tax Purposes.

## Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 330 of 1923.]

[3rd August, 1923.

### BRANCH ROAD: FERUKA SIDING—RAHEEN FARM.

IT is hereby notified that His Honour the Administrator has been pleased, under the provisions of section 2 of "The Road Regulations, 1896," to declare the following road to be a branch road, *i.e.*, from the homestead on farm Raheen, in the Umtali district, running thence generally in a north-westerly direction over Raheen, across the south-western end of Weirmouth and into Hillandale to Feruka railway siding.

No. 417 of 1923.]

[14th September, 1923.

### BRANCH ROAD FROM DORA FARM TO HEADLANDS STATION.

IT is hereby notified that His Honour the Administrator has been pleased, under the provisions of section 2 of "The Road Regulations, 1896," to declare the following route to be a branch road, *i.e.*, from Headlands railway station on the northern side of the railway line running in a south-easterly direction parallel to the railway over the Yorkshire Estate for a distance of about 2.4 miles, turning thence north-easterly and northerly over Yorkshire Estate and Riversdale, running through the latter farm along the ridge between the Mwarazi and Nanzou Rivers, continuing along this ridge into Mgadza and crossing the Mwarazi River just above the junction of the said two rivers, and running thence north-easterly through Mgadza into Nyamangura to the homestead thereon, and thence running easterly over Nyamangura into Dora to the homestead thereon.

No. 401 of 1923.]

[7th September, 1923.

HIS Honour the Administrator in Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notices Nos. 281 and 365 of 1923, and, in terms of section 17 of Government Notice No. 21 of 1917, to declare the following areas of infection and guard area in lieu thereof:—

### CHARTER AND CHILIMANZI NATIVE DISTRICTS.

#### (a) Areas of Infection.

1. The Wiltshire and Worcestershire Estates.
2. The farms Norah Lee, Homanhurst, Altona and the Mangeni Reserve.

3. The farms Swartfontein, Rooipoort, Rockydale and Ferreiraton Commonage.
4. The farms Onze Rust, Elminie and Inhoek.
5. The farms Jackalsdraai and Kopje Alleen.
6. The farms Stockdale, Spurwing and the Narira Reserve.
7. The sub-division of Nyamazaa known as Hoffmania.
8. The farm Totton.
9. The farm Swindon.
10. The farm Chipisa.
11. The farm Mooifontein.
12. An area within a radius of four miles of Mswana's Kraal in the Sabi Reserve.
13. An area within a radius of four miles of Bindura's Kraal in the Sabi Reserve.

HARTLEY, MARANDELLAS, CHARTER, CHILIMANZI AND GUTU  
NATIVE DISTRICTS.

(b) *Guard Area.*

An area bounded by and including the farms Mserenge, Glynn, Bucknall, Sunnyside, Vergenoeg, Alpha, Pot Luck; thence down the Sabi River to its junction with the Rumwengi River; thence up the latter to its headwaters; thence in a south-westerly direction to the headwaters of the Nyamhonga River, and down this river to its junction with the Nyadzidza River, and up the latter, the Inyazitza and Nyamatsetse Rivers to the farm Riversdale; thence by and including the farms Riversdale, Markdale, Vroege Veld, Jackal's Bank, Wash Bank, Swart River, Love Bean, Samen Komst, and that portion of the Central Estates lying north-east of the Umvuma-Rhodesdale Road; thence along the eastern boundaries of the farms Sebakwe, Xmas and Bushy Park, and thence along the boundary of the Charter native district to the farm Werwaching; thence by and including this farm and the farms Wheelerdale, Adlam's Rest, Brakveld, Gorali, Orangia, Emondo, Georgina, Maas Plein, Xekene, Balcome; thence along the Charter Road to the farm first named.

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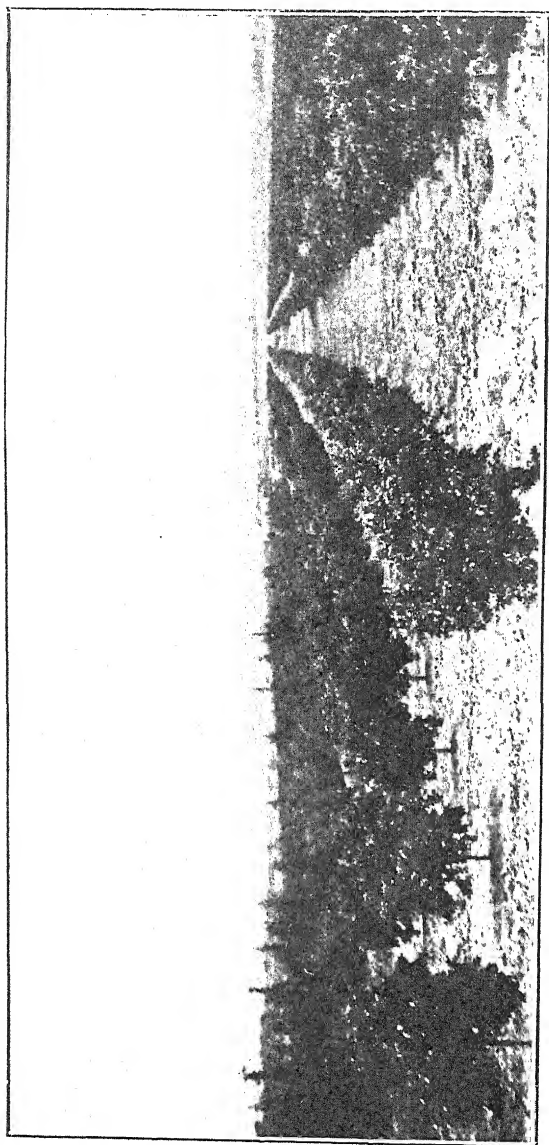
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**B.S.A. Co.'s Estates Department, Box 583, SALISBURY.**







A portion of the British South Africa Company's cypress groves at Sinoia, with Sinoia in the distance.

# THE RHODESIA Agricultural Journal.

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## Editorial.

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*Contributions and correspondence regarding subjects affecting the farming industry of Southern Rhodesia are invited. All communications regarding these matters and subscriptions and advertisements should be addressed to:—The Editor, Mr. W. E. Meade, Department of Agriculture, Salisbury.*

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**Gwelo Agricultural Experiment Station.**—Following on the public-spirited action of the Bulawayo Municipality in establishing a dry land experiment station on the town lands, the Municipality of Gwelo has decided to adopt a similar policy. To this end a suitable area of land lying alongside the Selukwe railway line, and about a mile from the main street of Gwelo, has been selected and set aside for the purpose. Ten acres have been fenced and laid out in half-acre plots, and a further ten acres adjoining have been reserved to enable the area to be extended when need be. The soil is a red loam typical of a good deal of the "formation" soil of the Gwelo district. The land has been broken up during the past dry season and has been brought to an excellent state of cultivation through the keen efforts of the municipal officers entrusted with the work.

The object of this experiment station will in the first instance be that of the small demonstration farm to illustrate the variety of

crops which can be grown in the district and to ascertain the varieties best suited to local conditions. One or two rotation experiments are also being laid down and, it is hoped, may be continued for a number of years. The Department of Agriculture organises and periodically supervises the work and supplies the necessary seeds and fertilisers. The municipality provides the land, draught animals, implements, native labour and the immediate European supervision which the work calls for. The produce of the station remains the property of the municipality.

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**Union Cattle Markets.**—Cattle from Southern Rhodesia are almost exclusively despatched to the quarantine market at Johannesburg (Newtown). It is not sufficiently realised by the public that it is permitted to send cattle from Rhodesia to the quarantine markets on the Rand at Germiston and Randfontein, whilst there is prospect in the early future of Benoni and Brakpan also being recognised as quarantine markets. In addition, cattle from Southern Rhodesia may be sent to the quarantine markets at Pretoria, Pietermaritzburg or Durban. It not infrequently occurs that cattle consigned originally to Johannesburg are re-consigned to the other quarantine markets on the Rand mentioned above, which involves additional expense and fatigue to the animals. In these cases it would have been advantageous to have sent the stock direct. This is a matter which deserves the earnest consideration of exporters of cattle.

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**The Southern Rhodesia Egg Circle.**—The egg circle has progressed since its inception with varying degrees of success. A manager-tester was originally appointed for each depot and a committee formed at the different centres. The members of committees gave their time gratis to the work, but it was recognised that co-ordination and true co-operation were lacking between these committees. It was therefore decided to obtain the services of Mr. A. I. Thorpe, lately a director of the Cape Egg Circle, as manager of the Salisbury depot and general manager of the egg circle. Mr. Thorpe is now re-organising the circle on business lines which bid fair to make it a big success and a great benefit to producers and consumers of eggs. It is the intention to form the egg circle into a limited liability company, which should prove beneficial to members and their interests. There must, however, be loyalty, co-operation and assistance from members. With the recognition and practical application of these fundamental principles by members there is no reason why the Southern Rhodesia Egg Circle should not become a factor of prime importance in the development of the poultry industry of this country.

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**The Tobacco Industry.**—At a meeting of members of the Rhodesia Tobacco Co-operative Society, held in Salisbury on the 15th November, a resolution was passed dissolving the society and trans-

ferring the liabilities and assets of the society to the newly formed Rhodesia Tobacco Warehouse and Export Co., Ltd. Mr. S. W. Croxford was appointed liquidator. The first annual general meeting of the new company was held on the same day, when the following were appointed directors: Messrs. M. E. Cleveland, A. C. Henderson, D. S. McLachlan, G. H. Walker and Capt. F. Smith. Considerable discussion took place in regard to the policy of the new company, and this will no doubt be announced at an early date.

**Tobacco Preference.**—The acceptance by the Economic Conference of the proposal to increase the tariff preference on Colonial-grown tobacco imported into the United Kingdom is a further proof of the desire of the Imperial Government to encourage the production of tobacco in the Colonies. The increase amounts roughly to 8d. per lb. and applies both to manufactured and unmanufactured tobacco. It will be remembered that a rebate of one-sixth of the duty was granted in 1919, but unfortunately it cannot be said that the producer reaped any direct financial benefit therefrom. The effect of the preferential duty has been to induce manufacturers in Great Britain to use Colonial-grown tobaccos in their blends, and thus to stimulate production in British Possessions. In the year 1922 the imports of unmanufactured tobacco into the United Kingdom from British Possessions amounted to 12,653,513 lbs., or 6.8 per cent. of the total quantity imported. The rebate obtained by reason of the preference amounted to £843,550, practically all of which went to the manufacturers. In 1913 only 2,180,541 lbs. of unmanufactured tobacco were imported from the Colonies. The preference will now amount to 2s. per lb. and will undoubtedly promote keener competition among manufacturers for Colonial-grown tobacco. In this way prices should improve and a ready market become available for all leaf of suitable quality.

We in Southern Rhodesia have not yet arrived at the exporting stage, but the time is rapidly approaching when production in this Colony will exceed the requirements of South African manufacturers. We shall then turn naturally to the British market to dispose of our surplus, and the concession so generously granted by the Imperial Government should enable us to sell our tobacco at a profit. An assured and profitable market in Great Britain is a factor of tremendous importance to us, and there is no reason why we should not contribute our proportion of Empire-grown tobacco.

**The First Rhodesian Tobacco.**—Some time ago we referred to certain tobacco, sown at Filabusi in October, 1900, as the first grown in Rhodesia. We have now had our attention drawn to an even earlier experiment by Mr. W. Harris at Redleaf, Nyamandhlovu, for Messrs. Dechow & Tweedale, who hold a first prize certificate, presented to them by the Bulawayo Agricultural Society, for leaf tobacco exhibited at the show held on 1st June, 1899. The seed from which

this tobacco was grown came, we are told, from Australia, and it must have been grown during the season 1898-99. Can any earlier claim be put forward?

**Maize Yields.**—The following figures relating to production of maize are taken from a recent bulletin issued by the International Institute of Agriculture, Rome:—

| Season.           | Country.        | Total Yield,<br>Bags (200 lbs.). | Yield per<br>Acre, Bags<br>(200 lbs.). |
|-------------------|-----------------|----------------------------------|----------------------------------------|
| 1923              | U.S. of America | 861,164,100                      | 8.35                                   |
| 1922-23           | Argentina       | 42,880,050                       | 5.46                                   |
| 1923              | Canada          | 4,585,300                        | 13.55                                  |
| 1922              | Egypt           | 20,581,450                       | 10.00                                  |
| 1923              | Italy           | 23,589,550                       | 6.44                                   |
| 1920-21 (average) | Rumania         | 32,494,050                       | 3.86                                   |
| 1923              | Hungary         | 14,801,600                       | 6.00                                   |
| 1923              | Bulgaria        | 6,161,950                        | 5.14                                   |
| 1923              | Spain           | 6,725,100                        | 5.75                                   |

The maize crop of Southern Rhodesia for the season 1922-23 is expected to approximate 1,447,000 bags, and the yield to be slightly over six bags per acre.

**Export of Oranges.**—Since the beginning of May last some 45,000 cases of oranges have been railed from Rhodesia to Capetown for shipment overseas. As mentioned in the last issue of this *Journal*, some of the earlier consignments of Washington Navel oranges arrived at Capetown in a wasty condition, due to the heavy and late rains of last season, but no further trouble was experienced until the very last shipment of the year, when a certain quantity had again to be condemned. Prices on the whole this season have been satisfactory, and recent consignments have realised from 25s. to 35s. a case, the lesser of which figures should leave a handsome margin of profit to the grower. All the fruit from Rhodesia has been exported under the auspices of the Fruit Growers' Co-operative Exchange of South Africa, Ltd., which now includes the majority of citrus growers in the Union.

**Export of Slaughter Cattle.**—The following are the dressed weights of fourteen bullocks and six cows recently sent to Johannesburg from the B.S.A. Co.'s Shangani Ranch and sold at 40s. per 100 lbs.:—  
Bullocks: 933 lbs., 923 lbs., 890 lbs., 889 lbs., 852 lbs., 820 lbs., 804 lbs., 784 lbs., 780 lbs., 754 lbs., 782 lbs., 757 lbs., 745 lbs., 710 lbs.  
Cows: 855 lbs., 742 lbs., 670 lbs., 669 lbs., 612 lbs., 530 lbs. In this connection it is interesting to recall that the dressed weight of the champion ox at the recent Rand Fat Stock Show was 937 lbs.

**Cheese Export.**—It is gratifying to learn that cheese is being exported from Rhodesia to the Union, where it is competing on the Rand market with Canadian and New Zealand cheese. The drought in the Union has affected the dairy industry very considerably, and large quantities of both butter and cheese are being imported from overseas. In Mashonaland the supply of local cheese seems to be likely to exceed the demand, but Matabeleland should be an outlet for the surplus. Large quantities of cheese come into Bulawayo from Bechuanaland. This market ought either to be supplied locally or by Mashonaland, and we look forward to the time when, as is already the case with butter, the export of cheese from Rhodesia will exceed the quantity imported.

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**Milk Records.**—It is to be regretted that it has not been possible to include the latest returns of the Rhodesian milk records in this issue. They will, however, be brought up to date and published in our February number. It is satisfactory to be able to report that several further cattle owners have applied for registration forms and have promised to support the scheme. It should be borne in mind that very little advantage is to be gained by the recording of only one cow in a herd. No farmer should record less than five cows if he is to gain an exact knowledge of the average production of his herd. It is to be hoped, therefore, that the number of cows which are being recorded will show a considerable increase in the future.

---

**Locusts.**—The invasion of the eastern portion of Mashonaland by locusts which was mentioned in the last issue of this *Journal* (October) apparently came to an end on or shortly after 4th October, which is the last date with reference to which any reports of locust movements have been received. On that occasion a swarm was reported as passing from the Hartley district into Charter. The districts traversed by the flying swarms include Umtali, Makoni, Marandellas, Hartley, Charter and Melsetter. Specimens were obtained from Makoni district early in the invasion by Mr. C. B. Symes, Assistant Entomologist. On examination it was found that the species involved was neither the Brown Locust (*Locusta pardalina*), which has caused so much trouble in the South African Union for years past, nor the Red Locust (*Cyrtocanthacris septemfasciata*), which is known as the common east coast species in South Africa, but a species hitherto unrecorded in Southern Rhodesia. This was provisionally identified by Mr. Symes as *Locusta migratorioides*, the tropical phase of the Palearctic *L. migratoria*. Specimens were forwarded to the Division of Entomology at Pretoria, and this provisional determination was confirmed. From its markedly greyish appearance the popular name "Grey Locust" appears suitable for this species.

Female specimens obtained from Makoni as above were dissected and were found not to contain developed eggs but highly-developed air sacs, indicating that the insects were physiologically in migrating

and not reproductive condition. A very dilapidated female from Hartley in October was also found to be innocent of developed eggs, but the condition of the air sacs could not be determined.

No reports of egg laying have been received, and there appears every reason to hope that the invaders have left the colony before reaching the reproductive stage.

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**Black Welsh Cattle.**—The accompanying illustration shows one of a consignment of four Black Welsh bulls imported by Dr. A. M. Fleming, C.M.G., from the Black Welsh Cattle Society. When the photograph was taken the bulls had been inoculated at the Veterinary Bacteriological Laboratory, Salisbury, against red water and gall-sickness, and were shortly to be despatched to their destinations, viz., one to Dr. Fleming's ranch at Marandellas, one to Mr. G. N. Fleming's farm near Salisbury, and two to Mr. G. A. Dobbin, Omeath, Umvukwe. The intention of Dr. Fleming is to mate his bull with Mashona cows with a view to obtaining a cross suited to the conditions of the country.

These bulls are, we believe, the first of the breed that have been introduced into Rhodesia, and very little is known of them here. The illustration shows that the bull pictured has made good growth for his age, while the conformation is pleasing. Black Welsh cattle have the reputation of being a good dual purpose breed, and the experiment will, we trust, produce the desired results.

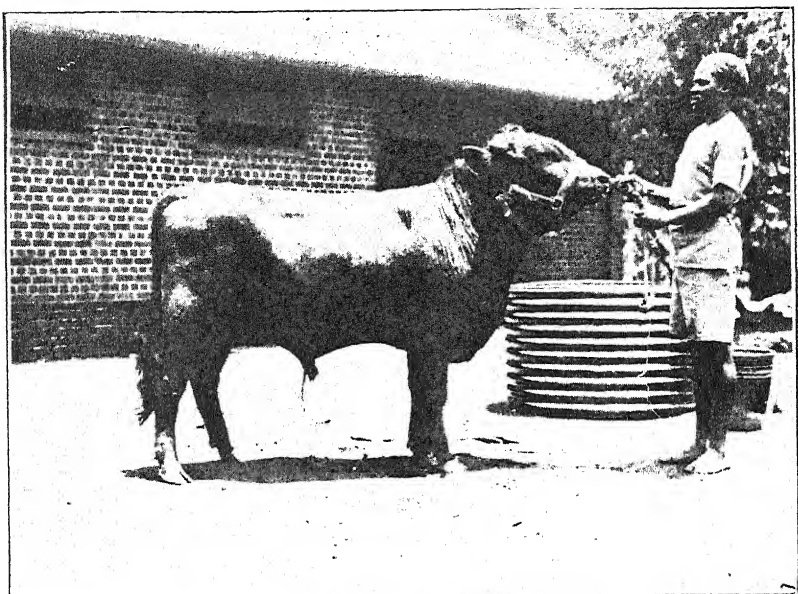
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**"Tree without a Name."**—In the Marandellas district, on the Dudley Estate, about three miles south of Nengubo Mission, stands a somewhat remarkable tree. Its height, judging from a photograph, must be about 60 ft. Its age is not known, but must be considerable, for it has been an object of veneration to the natives from the early days of the Barozwi. The tree is a conspicuous landmark for miles around, and the Mashona assert that it is the only individual of its species in the country, hence the name "Muti sine zita," which means the tree without a name. The Barozwi were in the habit of meeting periodically at the tree for the purpose of dancing round it, on which occasions they deposited offerings of black cloth and beads at the foot of the tree. No ceremonies of this kind have taken place for many years, and their exact significance has not been ascertained.

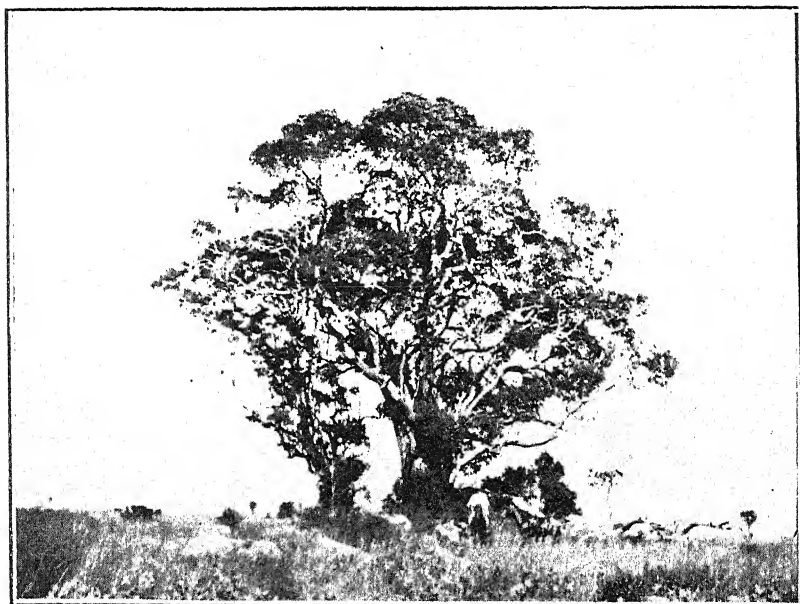
Whether the "Marandellas" tree deserves or not the unique distinction ascribed to it by the natives as a solitary specimen of its kind cannot be stated at the moment, but it is extremely unlikely that it is completely isolated. All that we can say for the present is that it is a species of *Schrebera*, and that it differs from the only other *Schrebera* so far found in Rhodesia, viz., the Mazoe *Schrebera*.

For the photograph and most of the information given above we are indebted to Mr. F. W. T. Posselt, Native Commissioner, Marandellas.





Black Welsh 15 months old bull imported by Dr. A. M. Fleming, C.M.G.



"Mutu sine zita" (tree without a name). (See editorial notice.)



**Estimate of Seasonal Rainfall.**—The official estimate of the mean rainfall in Southern Rhodesia this season is 27.8 inches, i.e., just slightly under normal. This estimate is based on the periodic nature of the mean rainfall curve, Indian monsoon rainfall and flood height of the Blue Nile at Khartoum. The probable error of the estimate is 3 inches, and it is considered probable that the actual result will tend towards the lower limit, and that the mean rainfall will probably be about 3 inches under normal. Owing to the scanty nature of the early rains to date, if this estimate is fulfilled it should not be an unduly unfavourable season for ordinary crops.

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**Administration of Quinine.**—Attention is specially drawn to the article "Quinine Prophylaxis in Malaria" written for this issue of the *Journal* by the Medical Director. In this article Dr. Fleming gives precise directions regarding the taking of quinine as a preventive of malaria, while he outlines a course of treatment should infection be incurred. In mentioning the foregoing we would advise those who are exposed to infection to procure from the Department of Agriculture Bulletin No. 274, which contains twelve simple rules for the avoidance of malaria and blackwater. Government quinine of guaranteed purity is sold at all Post Offices and postal agencies throughout the country, the present price being 4s. 9d. a bottle of 100 tablets.

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**A Doubtful Practice in the Seed Trade.**—New and undesirable features of the farm seeds trade in South Africa are the advertisements which not infrequently appear in certain periodicals crediting with extravagant properties reputedly newly discovered fodder plants.

A case in point is a recent advertisement offering "Efwatakala" grass seed at 25s. per lb. The authors of the advertisement refer to the grass as "keeping off flies and insects and providing excellent grazing." They add, "every fruit grower and farmer must have some."

The grass thus named is nothing more nor less than molasses grass, which for several years now has been widely experimented with in many parts of South Africa. Molasses grass is undoubtedly deserving of trial as a grazing and hay grass in many areas, but that it will prove of any value for keeping off flies and insects from fruit trees, or indeed from anything else, is highly improbable. Investigations carried out by the poultry branch of this Department showed that the grass was useless for keeping away fleas and other insects from poultry scratching floors and nests.

Another instance of a somewhat similar nature may be found in the case of "Babala" grass, of which seed was, and still is, advertised in the advertisement columns of a leading South African farming paper. This "extraordinary fodder plant" on being grown at the Salisbury Experiment Station proved to be nothing more than pearl millet, a crop grown for years by the natives of South Africa and Rhodesia under the names of n'youti, munga, um-velli-veli, etc.

There can be no question that in the laudatory notices referred to, the merits of the grasses are wilfully exaggerated with a view either of catching the unwary farmer or of inducing him to pay a higher price for the seed than its actual worth. The more proper course for the vendors to adopt would be to advertise the plants under the name they are commonly known by, not under one which infers that they are newly discovered crops.

Farmers will therefore be well advised to seek advice before purchasing seed of crops which are advertised under fanciful names or to which exceptional properties are attributed.

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## Spaying of Cattle.

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Owing to lessening values, more cows and heifers than usual are being spayed this year.

The most suitable time for spaying is early spring or autumn, but it can be done safely at any time provided feed is plentiful. Cows in calf can be spayed, and after the loss of the calf, which follows in a few days, they fatten well.

Mr. David Wilson, of Bomerah, with a wide experience of spaying, writes that it is not advisable to spay heifers that are in calf and forward, as they do not abort so easily as older cattle, and usually fall away in condition after being operated on.

Mr. Wilson gives the following suggestions in regard to the operation:—The cattle should be yarded 18 to 24 hours before being operated on, and if possible let straight out of the bail when done into the paddocks. They should be turned into a handy paddock with plenty of feed and water, not shifting them any distance for at least 24 hours after the spaying.

Lysol, Mr. Wilson considers, is the best antiseptic to use. The part to be operated on should be clipped and washed with antiseptic before making the incision, and arm and hands should be washed in antiseptic after treating each beast. Roping and bailing and all yard work should be done by assistants.—*Pastoral Review*, August, 1923.

# Soil Washing,

OR

## THE SURFACE EROSION OF CULTIVATED LANDS.

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By A. C. JENNINGS, Assoc.Mem.Inst.C.E., A.M.I.E.E.,  
Government Irrigation Engineer.

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There appeared in *The Rhodesia Agricultural Journal* for October, 1921, and later published in Departmental Bulletin No. 400, an article dealing with the above subject. It is felt that many farmers have regarded and continue to regard the matter merely of academic interest, and still do not appreciate the serious nature of the washing or scouring of their cultivated lands, which continues progressively from season to season. On the other hand certain farmers, particularly in the maize belt, are very fully alive to the position, and are taking active steps to deal with the evil. It is still claimed by many that erosion is not a serious problem in Rhodesia; and if judged by the limited number of dongas or washed out watercourses one sees in the veld, then they are probably correct, but certainly not so as far as cultivated lands are concerned. In this latter respect the writer has no hesitation in saying that conditions here, due no doubt to the more tropical climate, are a good deal worse than in many parts of the Union of South Africa; and if not taken in hand seriously, will assuredly result in a very few years in the ruination of the best cultivated lands of the country. The situation may be briefly summed up by saying that where the veld is still in its undisturbed condition and clothed with its natural vegetation, erosion does not occur to any serious extent, but on cultivated lands, especially those on fairly steep slopes, and growing crops requiring a clean tilth, the trouble is very serious indeed.

The remarks in this article do not perhaps apply with equal force to all parts of the country, but it will possibly be correct to say that the washing of cultivated lands varies as the following factors:—

- (1) Number of showers during season which exceed one inch per hour.
- (2) Slope of land.
- (3) Condition of surface and saturation of ground at the time rain occurs.
- (4) Physical characteristics of soil.

The more arid areas of less rainfall do not suffer to the same extent as the more humid parts, but all the same it is as well not

to be lulled into a sense of false security, because even in those localities where perhaps the mean annual rainfall does not exceed 20 inches, showers of very heavy intensity amounting to one or two inches per hour do occur and often cause enormous damage.

Soil washing must be regarded as another of the "necessary" evils which arise from carrying on agricultural operations in sub-tropical countries; and while the position is extremely serious, it is by no means desperate, but there is no time to be lost.

In many countries, especially in the East, the construction of terraces and banks for soil protection has been from time immemorial carried out and regarded as a necessary part of agriculture in a like manner to which drainage and similar operations are conducted in the wetter countries of Europe. On the eastern side of Rhodesia, notably between Headlands and Inyanga, there are still distinct evidences of hillsides which have been terraced from top to bottom. These have been built up with dry stone outer walls so that level terraces are formed from which no soil can be removed. The early inhabitants or occupiers of this country evidently realised the absolute necessity for this work as being essential to their existence. The present day farmer, while not being urged to terrace his hillsides, is certainly urged to protect his cultivated lands from surface wash. He may well say that such work is very expensive, and if the cost is to be added to the capital value of the land, then it is not worth while if only a low-priced crop such as maize is to be grown. There is a good deal of force in this argument, and the only reply that can be given to-day is that there are two alternatives, and he must obviously choose between them, viz.:—

- (a) *Protect the lands and retain their fertility even at some cost; or*
- (b) *Allow the lands to wash and become useless in a few years.*

Before proceeding to describe the various protection and other work recommended, it may not be out of place to touch upon a form of erosion known as "headstream" erosion, closely allied to the foregoing, but yet not quite the same. The headstream erosion referred to here may be perhaps better described as "vlei erosion." The vleis or sponges which exist at the head of or along the course of many of the small streams in the schist areas of Mashonaland are usually extremely rich, deep, black soil, and it is unquestionably a great temptation to the farmer to plough up such lands in order to secure a high yield often of 25 or more bags of maize per acre from such land. These vleis in their natural state grow a very dense mass of grass and vegetation, and are usually wet throughout the dry season. The first thing done preliminary to ploughing is to cut a drain right down through the vlei in order to take away excessive moisture and make it "suitable for cultivation." A very short time elapses before the trouble commences, and in one or two seasons the erstwhile drain has become an ugly donga with tons of soil carried away for a considerable distance from either side. Even when this has happened, many farmers, so avaricious of what they call their "best land," continue to plough right up to the edge of such a donga, and each

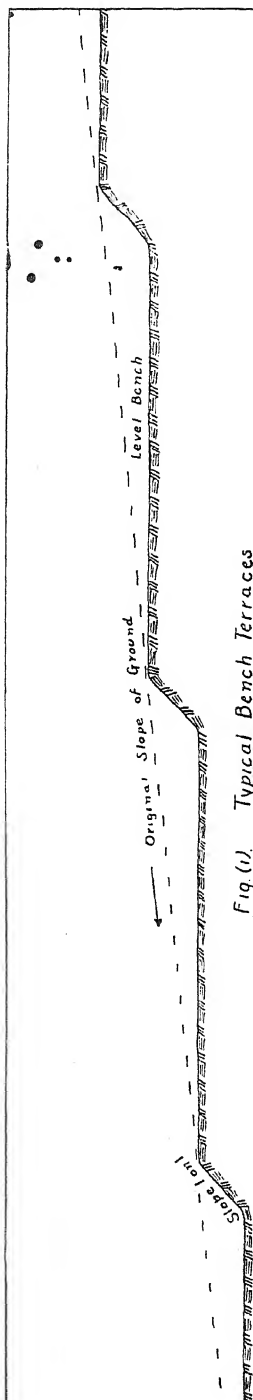


Fig. (i). Typical Bench Terraces

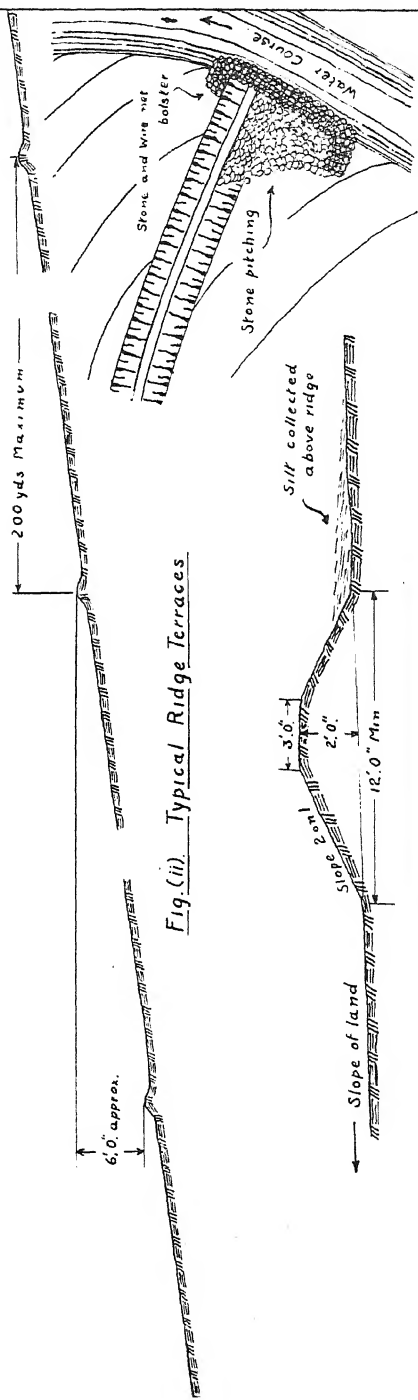


Fig. (v).

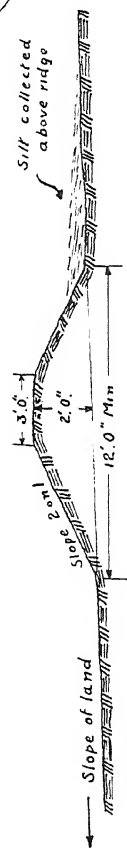


Fig. (iv). Cross Section of Ridge





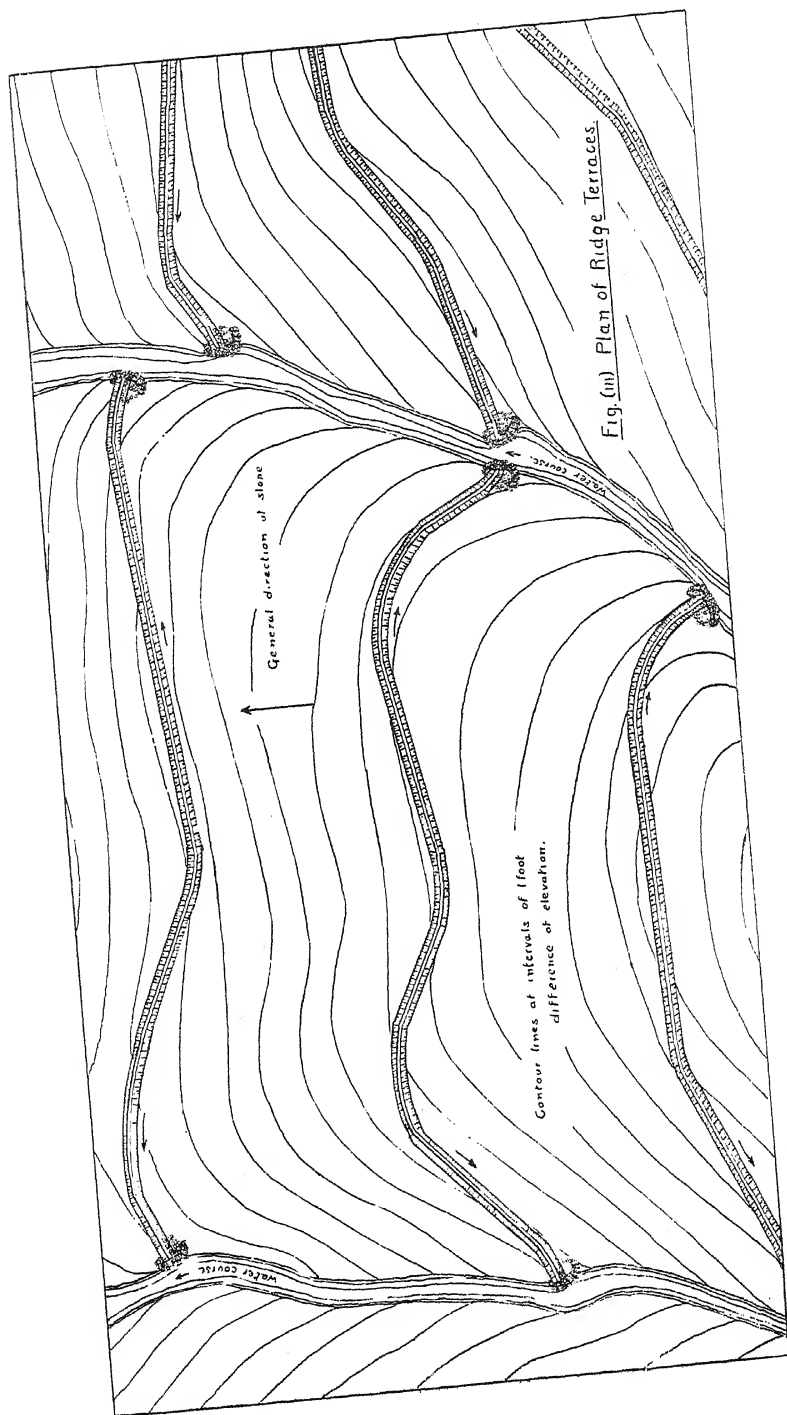


Fig. (in) Plan of Ridge Terraces.



year sees a gradual cutting back and increased loss of soil. This absurd procedure continues until the whole vlel is practically destroyed.\* Wet vlels of the former kind are obviously valuable natural features on any farm; and apart from their value in checking rapid run-off and balancing the stream flow, they provide most excellent winter grazing for stock. Any man who cares about the future of the country would refrain from ploughing such a vlel, or only cultivate certain pieces with extreme care. One farmer rather wiser than many once said to the writer that he would not plough a certain vlel on his farm for "all the gold in Rhodesia." It is a pity there are not more of the same opinion.

**Protection Work.**—The various measures which are recommended for checking and correcting the "wash" of cultivated lands will now be dealt with, and in doing so it must be realised that there is no "short cut" to achieve the end in view, but each operation must be carried out as part of a set programme which may take two or more years to complete. The water to be dealt with occurs in the following two ways:—

- (a) That which falls on adjacent hillsides and runs off in the form of storm water on to the land.
- (b) That which actually falls in the form of rain directly on to the cultivated area.

**Storm Water Drains.**—Obviously the first step to be taken is to intercept any water from extraneous sources flowing on to the land, and this can be achieved by cutting storm water drains on the upper side of all lands likely to receive water in this manner. The dimensions of such drains will vary according to the quantity of water which it is anticipated they will be called upon to discharge. In this connection it may be mentioned that the run-off from hillsides is largely determined by the condition of the veld at the time the rain occurs. Adequate grass and bush cover checks run-off to a very large extent; care should therefore be taken that veld land and hillsides adjacent to cultivated lands should not be heavily grazed, and if possible should not be allowed to be burned. In this manner rapid run-off can be checked and the size of the storm water drains somewhat reduced. In general they may be from 3 to 5 feet bed width and about 1 foot 6 inches deep; they should be preferably wide and shallow rather than narrow and deep. Details of their construction are given in Bulletin No. 400; and care must be taken that the water from these drains is taken care of at their lower ends and passed into some natural watercourse or depression where suitable protection is made so that damage cannot occur.

**Natural Watercourses.**—It is not always possible to intercept all water from the adjacent higher land or hillsides by artificial storm water drains, and in such cases it may be desirable to allow water that comes from large valleys or kloofs to continue to pass down over

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\* The wet vlels here referred to are not those which occur in the granite and sometimes used for wheat growing. Even these require to be cultivated and handled with care.

the land in its natural depression or watercourse. In the past, when clearing new lands little or no regard has been paid to this matter, with the result that in the eagerness to secure wide uninterrupted stretches of land for ploughing, these watercourses have been cleared and ploughed. The immediate and inevitable result has been that where formerly a shallow depression existed, an ugly washed-out gully occurs, with consequent enormous loss of soil, and producing excessive drainage and lowering of the water table, both of which are extremely serious matters. To obviate this state of affairs watercourses in many instances must be allowed to remain in their natural condition, and arable lands in consequence cut into smaller areas. No ploughing should be done within 20 to 30 feet of the edge of such depressions, even although they are protected with their natural grass and bush cover. As far as possible they should not be burned out.

The next and perhaps most important phase of the whole problem, viz., that of protecting the cultivated land itself from the rain which actually falls on its surface, will now be discussed. There are two antagonising factors which make it of some difficulty, in that all surplus water has to be drained off and safely carried away, while the silt or soil has to be retained. Most farmers who have not given the matter close consideration start off by cutting drains in the land itself, but this is nearly always found ineffective. Such drains rapidly become choked with silt or are an impediment to agricultural machinery; and while perhaps serving to carry off water, do not assist in retaining the soil. Many of the red soils in the maize growing areas are underlain with a very compact clay sub-soil, which does not afford much sub-drainage, and saturation quickly occurs. Thus once the ground has become thoroughly soaked further rain that falls must flow off the surface, and requires to be taken care of so that damage does not occur. There appears to be little doubt that terraces or banks, and not drains, are the most effective means of affording the desired protection, and these will now be described.

*Bench Terraces.*—The ideal form of protection work is undoubtedly terracing, in which the land is cut into a series of level benches by removing the soil from the upper and spreading it on the lower side. The advantages derived from all forms of terracing are that when properly constructed the surface soil, with all its valuable humus and ingredients, cannot be washed away, in addition to which run-off is checked and deeper penetration of the rainfall encouraged. A typical form of terrace which can be constructed across land of any slope or shape is shown in Fig. 1.

While admitting the enormous value of terracing land in this manner, it is also realised that the cost where large areas are concerned would be absolutely prohibitive unless a more valuable crop than maize could be grown. For citrus cultivation terracing is considered in many cases economically feasible, as, in addition to the other advantages mentioned above, it facilitates irrigation.

*Contour Belts of Vegetation.*—In some cases where land is not too steep it is a sound plan to divide up the arable area into ploughed strips running across the slope in the direction of least fall. At

intervals of about 200 to 300 feet or less an unploughed strip about 15 feet in width is left and maintained under either its natural grass cover or used as a roadway across the land. The general effect of this arrangement is that any direct flow of water down the land is checked at the grass strips and silt is also held up. If silting is severe the strip in course of time tends to become higher than the adjacent land, which then assumes a more or less terraced form. Lands which are intersected at frequent intervals with depressions or drainage channels running down the slope would not be very suitable for this form of protection owing to the tendency for all water to collect in these, unless special provision were made.

*Ridge Terraces.*—Of the alternative forms or systems for the protection of cultivated lands, these are regarded as being as efficient and practical as any. In Figs. 2 and 3 are shown the ridges in section down the slope and in plan across the slope respectively.

The construction of these ridges consists in throwing up broad base banks of earth on a uniform falling grade across the general slope of the land. These serve the purpose of collecting and directing the water along the upper side, where it flows with a moderate velocity, insufficient to cause scour or carry silt. In this manner all particles of soil washed down are held up behind the bank and a series of terraces are created. The grade of the ridges will vary, according to the capacity of the soil to take up water, from being quite level to a fall of 3 to 6 inches per 100 feet. It is sometimes advisable to steepen the grade somewhat towards the outfall end.

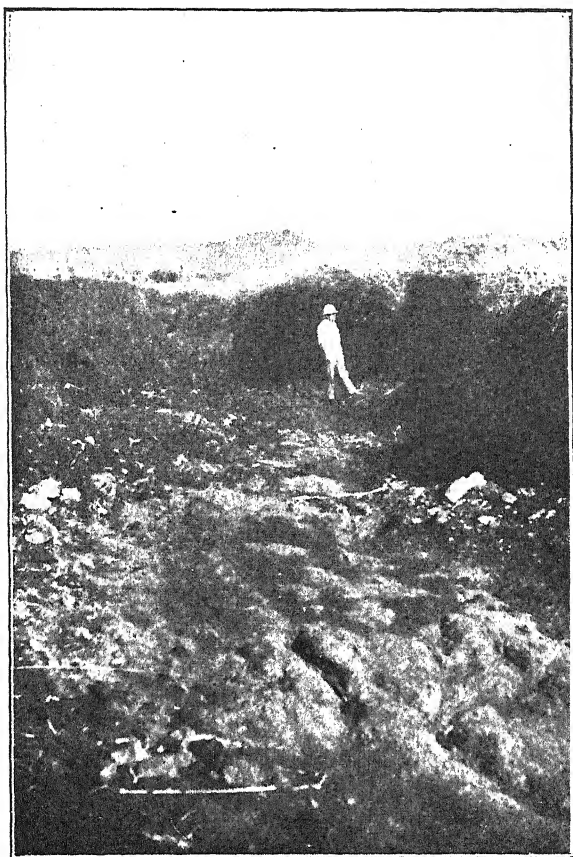
The spacing of ridges is controlled by the slope of the land. It would be ideal to place them so that the difference of level between successive ridges equals the height of ridge, but this would bring them too close together on steep land. In general practice a ridge every 6 feet of fall in the land should be found effective, but further experience may suggest some modification of this.

The setting out of the ridges is a matter which requires very careful attention, and farmers would be advised to seek professional advice in the matter, or at least have accurate levels given by someone able to use an engineer's dumpy level. The best plan is to ascertain by trial levels the approximate position of the ridge, then drive in pegs about every 100 feet along this line. These pegs will stand about 2 feet above ground surface and adjusted so that the top of each peg is at the correct level of the ridge at that point. If facilities are not available for fixing the pegs in this manner, the farmer can by the use of a large A frame level fix them himself, as explained in Departmental Bulletin No. 419 on "Irrigation Canals." The grading of the ridges is of extreme importance, as any errors in this respect will result in water overtopping and breaking the banks. The ridges normally will have a height of about 2 feet, and the other dimensions conforming to this height will be as shown in Fig. 4. In crossing depressions they should follow through on their grade, but where this involves sharp turns it may be advisable to take them in a more direct line and give the bank an increased height at this point; the side slopes of the ridges will then remain as before and the base width correspondingly

increased. The winter season obviously will be the time the farmer will select for this work, but it will be necessary to see that the soil is broken down to a fairly fine condition, and a little moisture in the soil will be an advantage in assisting consolidation.

The actual methods of construction have not yet been touched upon here, as little experience has been gained so far in this country of this class of work. Hand labour, although effective and practical where only small areas are concerned, may be found too costly for large areas. Ploughing by back furrowing on a strip 15 to 20 feet wide is satisfactory where mules or horses are used, but hardly so with oxen. Some of the various scrapers and grading implements on the market may possibly be found as effective as anything, but the writer desires to satisfy himself by further experience before giving definite advice on this point. In the meantime farmers will no doubt evolve methods of their own which will be improved upon as the work proceeds. Each ridge terrace will have a definite point of discharge in some artificial drain or natural watercourse, and protection work, as shown in Fig. 5, will be required here to prevent back scour along the terrace. As to the cost of these works it is too early yet to give any definite figures, but it is thought that it will probably not be less than 7s. 6d. per acre. The ridges are generally sufficiently low and broad based to enable agricultural implements to work easily over them. In the case of ploughing this can be done usually along the slopes, but the planting of rowed crops such as maize should be done up and down the slopes in order that water may drain directly along each row to the ridge terrace. During the rainy season, especially the first one after construction, the ridges should be carefully examined at frequent intervals, and any weak places made good at once. Each dry season it may be necessary to go over them and put them in good order for the next rainy season.

This subject has been dealt with at considerable length to endeavour to impress on farmers and all land owners the extremely serious state of affairs existing in many parts of the country to-day. The rich red soil typical of the valley lands in the maize belt is all too scarce in Southern Rhodesia, and it is everyone's first duty to see that such soil, which is one of the country's greatest assets, and cannot be replaced, is not dissipated through ignorance and neglect.



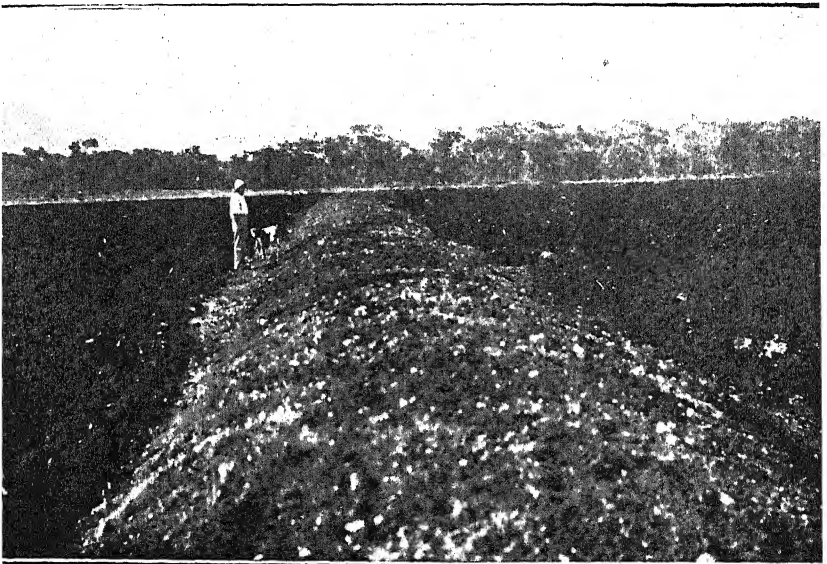
Donga through cultivated land, showing effects of erosion in one season on a farm in the Bindura district.







Typical ridge terrace, as constructed on Mr. G. Rattray's farm  
Kingston, near Bindura.



Typical ridge terrace, as constructed on Mr. G. Rattray's farm  
Kingston, near Bindura.



# Tsetse Fly.

## INSPECTION OF SHANGANI EXPERIMENTAL AREA.

By RUPERT W. JACK, F.E.S., Chief Entomologist.

In the account of the four years' experiment in game elimination which appeared in the *Rhodesia Agricultural Journal* for April and June, 1923, a further visit of inspection was foreshadowed. This was carried out by the writer during August of the present year, the visit occupying a period of four weeks. Owing to calls in connection with tsetse fly in other parts of the Colony, the time available for this inspection was strictly limited. The assistance of the hunters employed to shoot the game was, of course, lacking on the present occasion.

It was judged desirable that the inspection should be made at the beginning rather than at the end of the hot weather preceding the wet season, as it was important to obtain a view of conditions before both game and tsetse fly should have had a greater opportunity to respond to the less disturbed conditions which had prevailed since the closing down of the operations. There is no doubt that the tsetse fly breeds faster during these hot months than during the colder weather, though whether it actually increases in numbers may be questionable, and the concentration of game, as the water holes dry up in the surrounding country, would naturally afford the fly increased opportunities of feeding and possibly of increasing and extending its range. Comparisons of density of fly at definite spots in relation to the previous inspections in October could not, of course, be regarded as of value, and efforts were particularly directed to locating "fly," if present, south of the Shangani and up the Kana Rivers, and to making observations on the occurrence of game. As will be seen, however, some other observations of interest were recorded.

**Preliminary Notes.**—Before proceeding to an account of the inspection it is necessary to place the reader in possession of certain facts.

After the conclusion of the official operations the experiment area was sub-divided into four and included in the cordon of blocks which was established round the western, southern and south-eastern boundaries of the Sebungwe fly area in 1922. These blocks had been granted on

certain conditions to hunters who had the right to free shooting each within his own concession. The four blocks of the experiment area were all taken up in due course, and it was part of the writer's purpose to ascertain how the shooting was proceeding.

Secondly, it may be noted that during the previous two years the encroachment of tsetse fly, which had been proceeding steadily in almost all the affected districts of the Colony since 1897, had apparently received a considerable impetus, very marked advances, accompanied in many cases by much loss of cattle, having been recorded in Darwin, Lomagundi, Hartley and certain parts of Sebungwe. This general extension, therefore, constituted something in the nature of a control in the event of a different condition of affairs being found in the area of the experiment.

Thirdly, the Veterinary Department furnished the information that no cases of trypanosomiasis had been reported during the preceding wet season along the Gwaai River, a fact which could only be regarded as significant seeing that cattle were dying freely along this river from 1918 to 1921.

Finally, it may be noted that the season of 1922-23, following on the great drought of 1921-22, was one of the wettest on record.

**Itinerary.**—The reader is referred to the map illustrating the previous report in the *Rhodesia Agricultural Journal* for April, 1923. The writer proceeded from Kennedy Halt to Sikume Farm, camping there for the night, moved next day down the Gwaai River to Dingaan's kraals on the Dett, where the rest of the day was spent in inspecting cattle. Next morning the Dett was followed down to its junction with the Gwaai and the latter river crossed at that point, thence the path was followed down the Gwaai to close to the Gwaai-Shangani junction. Here the river was re-crossed and camp was made at Usamalamba's kraal, a mile or so beyond Sianyanga down the Gwaai River. This camp was occupied for four nights whilst the writer was exploring the vicinity under the guidance of a native from the kraal, who had been employed as a hunter during the operations. On account of a report of advance of tsetse since the previous year to the north of and beyond the limits of the experiment area, the path leading towards Mbopo's old kraal on the Madaba River was then followed for some seven miles to a water hole on the little Musita River, a tributary of the Gwaai. Here camp was made and the country beyond towards Mbopo's old kraal explored during the remainder of the day. Next day a straight cut through the bush brought the party to Sitimela's kraal on the Sibone and thence to the Shangani. Later the Shangani was crossed and a further straight cut made to the Madwala at the edge of the plateau. This camp was occupied for three days whilst the vicinity was explored, and then the party moved back to the Shangani at Msolozhi. From here the Lubimbi and Bira regions were examined, the excursions ranging as far as Main Camp No. II. A move was then made to the last mentioned camp, which was used as a centre for two days. Main Camp No. I. was the next halting place, being occupied for three nights in all.

Thence the party proceeded up the Kana River to the Palm pan, where a further two days were spent, and from here the pan up the Mzola beyond the nominal limits of the experiment was visited. The party moved back to Main Camp No. I. and, re-crossing the Shangani, proceeded to Sebasinungu's kraal, which served as a convenient centre for three days whilst the Shangani in the vicinity and Ngondo salt pan were examined. Thence the path was followed through Ngondo up the Shangani to the Mhlegwa crossing, and camp was again made here, the writer proceeding for some five miles further up the river on the south side. Next day the writer sent his carriers back to Sebasinungu and crossed the Shangani, spending practically the whole day on the north side, crossing again below F. Post and returning to Sebasinungu. From Sebasinungu the party returned *via* Gofwikila to Sikume Farm, and thence back to the railway. The ground covered during the visit was not less than four hundred miles.

**Trypanosomiasis on the Gwaai River.**—Observations and enquiries in this connection were for geographical reasons the first items on the programme.

It was found that considerably more cattle were present along the west side of the Gwaai River than had been the case at any time in the writer's experience in the past. This was chiefly due to several hundred head belonging to a timber cutter at Malindi, which were running on Farm 21 below Sikume Farm, but above the Dett River. Cattle in varying numbers belonging to the same owner had been resting and recuperating on this farm during the past two dry seasons, but had not been kept there during the rains. No cases of trypanosomiasis were reported amongst these cattle.

Sikume Farm was occupied by its owner with his cattle, but he had only been on the farm about one month. The previous occupier's cattle had, however, been running there from a few months after Mr. J. Kennedy vacated the farm in 1920, and had only been removed a very short time before the owner's arrival. Of these cattle one ox had contracted trypanosomiasis in 1920, but no further cases had occurred. The immunity of these cattle had, of course, been the deciding factor in connection with the owner's occupation of his farm. Mr. Kennedy had lost heavily in 1918, 1919 and 1920.

A Mr. Botha was found to have occupied Good Luck Farm on the north side of Sikume Farm and to possess a span of oxen. He had only been in occupation a few months, but had had no losses. Several natives also had cattle close to the Gwaai River between the farm and the Dett. These included Ndumo and a native known locally as Mafe-king. No sickness was reported amongst these cattle.

Chief Dingaan had fifty head at his own kraal, which had been there continuously. There were also several smaller herds at various kraals along the Dett River. No losses had occurred since 1921, except one ox, which appears to have died from some other disease. Blood smears were taken from the only two animals the writer could find which were other than in good condition. These were subsequently examined by the Director of Veterinary Research at Salisbury and proved

negative. Dingaan and his people lost very heavily from trypanosomiasis between 1919 and 1921.

The presence of spoor across the Gwaai River opposite the Dett junction showed that cattle had been grazing there, but the ownership of these cattle could not be ascertained.

Sianyanga had no survivor out of his small herd, which had only numbered about a dozen at any time.

In the writer's main report the subsidence of trypanosomiasis amongst the cattle along the Gwaai River in the 1921-22 season was not emphasised as additional evidence in respect to the effect of the shooting for the reason that that season was one of the driest on record, and it was thought that the drought might have been the direct cause, the writer's opinion being that most of the cases were due to transmission of the disease by blood-sucking flies other than tsetse. The writer is still of the same opinion, but subsequent transmission amongst associated cattle by this means is dependent upon original cases due to the "bites" of a tsetse fly, and the widespread occurrence of the disease in isolated herds along some sixty miles of the Gwaai River in 1920-21 is sufficient indication that tsetse was by some means carried across to that river comparatively freely up to that time. The failure of the disease to re-appear in the abnormally wet season of 1922-23 can, therefore, only be regarded as highly significant in respect to the apparent retrogression of the fly.

**Hunting under the Concession System.**—It was found that, notwithstanding the fact that all the four blocks into which the experiment area had been sub-divided had been taken up, there were no hunters operating in any one of them. Two hunters had operated in two of the blocks for two months, and secured in that time only fifteen head of game all told, but the remainder had found game so scarce or had heard that it was so scarce that they either had only stopped a day or so or had not put in an appearance at all. The whole area was, therefore, in a practically undisturbed condition, and buck were free to drift back into these formerly highly favoured haunts.

**Game.**—In considering the occurrence of game in the area it is necessary to take into account the fact that on the north and east side there is a well stocked reservoir of game to re-populate the depleted country, whilst on the south and west game is comparatively scarce. Under these circumstances the Shangani River interposes something of a barrier to re-stocking, which would be more than usually effective owing to the exceptionally heavy and continuous rains during the wet season of 1922-23. Consequently it was not altogether surprising to find game extremely scarce in the area south of the Shangani River, whilst some of the more favoured spots to the north of the river already showed signs of becoming re-stocked.

In all the area south of the Shangani from its junction with the Gwaai to Ngondo Salt Pan, a distance of thirty miles, only three head of big buck were seen during the visit. These consisted of a single specimen each of kudu, waterbuck and tsessebe. There was also very little spoor. At Ngondo a considerable herd of sable was seen,

and from their obvious lack of acquaintance with rifle fire were clearly either visitors or recent immigrants to the locality. Above the Mhlegwa-Shangani junction beyond the limits of the shooting operations game was found to be rather more plentiful, waterbuck, tsessebe, reedbuck and duiker being seen in one afternoon's walk.

North of the Shangani, impala, kudu and warthog were seen between the water hole on the Sianyanga-Mbopo footpath and Sitimela's kraal. Impala and rhino were found to have returned to the vicinity of Msolozzi and Lubimbi Salt Vlei, three herds of the former being seen. These were only moderately shy and may have come in from some other locality, but spoor of this species was plentiful in this vicinity, and the buck had obviously been there for several months at least. No game was seen between Lubimbi and the Mzola River along the north side of the Shangani, although the writer traversed wide areas of the forest on several occasions. Up the Kana only one warthog was seen, and between that river and the Mzola two impala, a herd of sable and two klipspringers were met with. These animals were all excessively shy. The highly attractive corner between the Kana and Shangani on the south side of the former near their junction showed signs of becoming re-stocked, one warthog, two waterbuck and one kudu being seen, whilst east of Chiswino Hill a small herd of roan was encountered.

It was perfectly obvious that in the two blocks delineated for concession purposes south of the Shangani in the old experiment area no hunter could make anything approaching a living out of shooting at the time of the visit, whilst even north of the river game occurred in nothing approaching its former numbers, but showed signs of increase since the conclusion of the operations.

**Tsetse Fly.**—South of the Shangani River below the vicinity of the Mhlegwa-Shangani confluence the only tsetse fly seen was a male taken on the banks of the Shangani at Main Camp No. II. after the party had crossed the river from the Lubimbi and Bira region, where fly had been in evidence. Careful search with the whole of the carriers at the spot during two days afterwards failed to reveal any more, and it may be taken that the fly mentioned was a "follower." The writer, moving from camp to camp along the river, made wide circuits through the forest over to the edge of the gusu and examined all the spots where fly had been met with on previous occasions, without success.

Ngondo Salt Pan and the neighbourhood of Sebasinungu's kraal received special attention, as also did the region of Bushu Salt Pan and the Gwaai-Shangani junction and of the Madwala. It is to be noted that a fly was taken close to the Gwaai-Shangani junction as late as October, 1922, and this region was therefore examined with the help of the carriers as thoroughly as possible during the present visit. The result was a complete negative.

Up the Kana one fly (a female) was taken in two days on the river opposite the Palm Pan, the carriers being turned out to search the banks thoroughly. None at all was seen below this point. A female was also taken in the mopani near Mogota Hill between the Kana and the Mzola.

No fly were seen on the Mzola at or near the index spots, but this is of little significance, as fly have never been recorded at the Mzola indices before September. One fly was seen but not taken about four miles north-north-east of Mzola Index No. I. At the pan with permanent water, some sixteen miles up the Mzola and well beyond the nominal limits of the operations, some seven flies (four males and three females) were taken on a visit lasting about an hour. No game was seen in this locality and little spoor. This region, as pointed out in the main report, was considerably hunted, especially in 1922, and appears to have been largely "shot out." Fly used to swarm in the late dry season at this spot.

West of the Mzola, along the north side of the Shangani, tsetse was more in evidence. In an excursion through Lubimbi and along the usually traversed portion of the bed of the Bira River, on to the Bira camp and south by the footpath to Main Camp No. II., five flies were taken, including one female in the bed of the Bira, one male not far from the bank and three males in the mopani about a mile south of Bira camp. It was after crossing the Shangani during this round that the male was taken on the south bank at Main Camp No. II.

Fly were found to be present in limited numbers around the northern sides of Lubimbi Salt Vlei and appear to be increasing again in these parts. Eight flies were taken on the north-west side and two males were taken and others seen on the north side in one afternoon's excursion lasting some  $3\frac{1}{2}$  hours. It is highly significant in view of the abundance of tsetse in 1919 and 1920 in many of the parts visited that the above figures represent the greatest number of flies seen in any locality during the present trip.

Four female flies were taken in two days in the mopani opposite Msolozzi's old kraal, that is, in and close to the writer's camp. A single male was taken at Sitimela's kraal, but this was probably a follower from further north.

Outside the area, on the path from Sianyanga to Mbopo, fly were found considerably further west than previous records. Last year in June from native testimony and the writer's notes the western limit of fly along this path was at Mbopo's old kraal on the Madaba River. The natives at Sianyanga, however, informed the writer this year that the fly had encroached further west. Accordingly the path towards Mbopo was followed and camp made at the water hole on the Musita River. There is permanent water at this spot, which is about ten miles north-north-east of the Gwaai-Shangani junction. Mbopo's old kraal site is about eight to nine miles to the north-east. Fly were encountered about three miles from where the Gwaai was crossed, that is about five miles north-north-east of the Gwaai-Shangani junction, and thence were in evidence to within a few miles of Mbopo. (The writer did not go quite to the latter locality.) It may be mentioned that although a wide circuit was made on either side of the path, tsetse fly were only seen close to the path, which is considerably traversed by natives visiting and coming from Chief Pashu's area. It was after moving straight through the forest from this water hole to Sitimela's that



the single specimen of fly was taken immediately on arrival at the latter kraal.

It would seem from the above observations that tsetse fly are now approaching the Gwaai River close to but to the north of the area of operations. With respect to this extension of the fly belt, it may be noted that the nearest camp to the area during the operations was on the Shangani River close to Bushu Salt Pan, and this was, of course, too distant to influence in any decided manner the region involved, which no doubt constituted something in the nature of a refuge to the persecuted animals. This shifting of the salient of the advancing fly from within the game elimination area to a region without constitutes a very graphic illustration of the effects of the shooting.

It should be noted that during the visit the mopani and other deciduous forest was still in leaf, although leaf-fall was proceeding very briskly in many parts during the last two weeks. Tsetse fly were, therefore, not concentrated into their late dry season haunts, and by far the majority of the few fly seen were taken in the deciduous forest where they would not be likely to occur later. On this account not only were the usual late dry season haunts inspected, but the mopani and gusu forest generally, and this entailed a vast amount of walking.

It may be worth noting that the weather throughout the visit was warm and for the most part sunny. No cold days occurred.

**Native Testimony.**—On the way down the Gwaai River the writer was somewhat perturbed at a persistent rumour that tsetse fly had appeared in numbers at Sianyanga's kraal, which would have constituted an increase and advance since the previous season. On arriving at the kraal, however, and questioning the more intelligent of the inhabitants, the rumour was promptly denied. The writer's chief informant, afterwards employed as a guide, stated emphatically that the fly had "gone with the game," and were not now to be met with anywhere in the vicinity, but called attention to the advance of the fly along the Mbopo footpath as above. This native had been employed as a hunter during the experiment.

*Sugela*, whose kraal is marked on the map, also stated that the fly had "gone with the game" from the vicinity of his kraal.

*Sitimela* (see map) said he sometimes saw fly at his kraal, but not many. The fact of a fly being taken there by the writer, of course, showed that the kraal was at least within "following" distance of infested country.

*Sebasinungu* and his sons denied the presence of fly either round their kraal or anywhere in the vicinity, including Ngondo Salt Pan, which is five miles further up the Shangani. They had no hesitation in attributing the disappearance of tsetse to the shooting operations. A piece of independent testimony from one of Sebasinungu's sons was passed on to the writer by Mr. Chatham when the former was proceeding down the Gwaai River. Mr. Chatham was, of course, very anxious about the position in regard to tsetse, and, hearing that a

native visiting his farm was from a kraal close to the Shangani, questioned him about fly. The native replied that there used to be numerous fly around his kraal, but now that the white man had shot all the game, the fly had also gone.

Along the Kana River runs a footpath considerably traversed by natives from up the Kana visiting and returning from Pashu's area to the north of the Shangani. This path runs through the Palm Pan, and during the two days the writer camped there no less than four parties of natives passed one way or the other. These were all questioned, and stated that the fly, which used to "bite" them badly between the Palm Pan and Bondo Hill, had now disappeared. The one specimen secured on the banks of the Kana near the Palm Pan shows that the fly have not absolutely disappeared, but, as these natives were merely passers-by and not residents, their statements may be regarded as sufficiently approximate. The contrast in conditions as regards tsetse along this path since 1921 to conditions obtaining in 1916, 1919 and even in a less degree in 1920 is in the writer's experience extremely striking.

**Note.**—An independent report on a visit to this region by a trooper of the B.S.A. Police in September-October, which was submitted for the writer's information, indicated that the position in regard to both game and tsetse fly had changed little since the writer's visit. Fly were only reported in the same localities as those indicated above, and the general scarcity of game south of the Shangani below Ngondo Salt Pan was emphasised. The report, however, indicated rather greater abundance of game than was observed by the writer at and above Ngondo and in the region north of the Shangani. This was to be expected in view of the annual concentration of game into these parts in the late dry season. Hunting under the concession system was, however, proceeding north of the Shangani.

**General Remarks.**—The extreme difficulty of establishing a complete negative in regard to the occurrence of tsetse fly by direct observation has been emphasised repeatedly in the past, and the writer does not, of course, claim to have done so in respect to any part of the area during this recent visit. These observations, however, taken in conjunction with previous inspections, the evidence of the hunters during the operations and local native evidence, can certainly be relied upon as indicating reduction at least to the absolute verge of extinction south of the Shangani River and marked scarcity up the Kana River, where the pest was formerly very abundant. With respect to the area south of the Shangani, the accumulated evidence during the past three years as to the extreme reduction of fly in this portion of the area is very great indeed, and figures prominently in the reports of the officers-in-charge. The last contribution under this head was made by Corporal Kemp, officer-in-charge, in his concluding report for November, 1922, namely: "It is certain that there is no fly south of the Shangani River." It must be pointed out, however, that fly are sufficiently near this river on the north side at certain spots to follow parties across. This is especially the case opposite Msolozì's old kraal, where the pest is still found in small numbers in the strip of mopani which comes close up to the bank of the river.

Fly also tend to follow from the mopani forest between the Bira and Mzola Rivers to the old main camp (No. II.), and this occurred regularly during the operations, although only occasional specimens were seen latterly. The tsetse fly appear to be increasing again around Lubimbi and along the north side of the Shangani opposite Msolози's old kraal, and this is only to be expected, seeing that impala, rhinoceros and other game have again taken up their quarters in this locality, which was in fact never kept altogether free during the operations.

It would be difficult under the conditions of this experiment to imagine anything more convincing in regard to the effect of removing the game than the position in regard to tsetse fly and game since and including the dry season of 1921. Had the fly disappeared entirely from all parts of the nominal area of operations, irrespective of the degree of reduction of game, one might well have suspected some other coincident factor. In point of fact, however, the areas whence the fly have apparently disappeared or been reduced to great scarcity are exactly those in which the shooting was most effectively carried out, and the remaining fly are clearly associated with the continued presence of the larger *Ungulates*.

To sum the position up, in the area of the experiment, through which, up to the first year of the shooting operations, the fly had been steadily spreading, having advanced some 12 miles towards the Gwaai River during the previous four years, not only has increase and advance been absolutely checked, but to all appearance the fly have been swept back to the north side of the Shangani over the whole 30 miles of the river included in the area. This gives a maximum depth of retirement of seven to eight miles. In addition, along the formerly heavily infested portion of the Kana River fly are now scarce and difficult to find, and the same remark applies to the north bank of the Shangani, at least from the Kana to the Mhlegwa crossing. The north bank of the Shangani between the Mzola and Kana was never to the writer's knowledge a favoured haunt of the pest, and was not examined during the recent trip.

Along the Gwaai River from the Dett River upwards, cattle have been living in health during the past two years in localities where they were dying in numbers up to and including the wet season of 1920-21.

If we add to these records the fact that fly have not only been encroaching steadily and generally in other parts of the Territory during the period the experiment has been in progress, but have also continued to spread and have occupied a considerable extent of fresh ground immediately adjacent to the area on both sides, the deduction is obvious.

The Shangani above the area of operations has not, of course, been available as a true control since 1921\* owing to the shooting, which

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\* In July, 1921, Mr. J. K. Chorley, Assistant Entomologist, found tsetse fly in evidence for at least 10 miles above the Mhlegwa-Shangani junction. Up to that year none had been seen above the junction.

commenced in 1922, under the concession system, and it may be that this shooting has had some effect. Limitations in regard to time did not permit of a thorough inspection of the Shangani along this stretch. One fly was caught some miles above the 1920 limit, and natives, whose statements had so far proved reliable, stated that fly still occur further up, but only in small numbers.

It is clear then that the results of this further inspection of the area are emphatically confirmatory of the conclusions detailed in the writer's previous report. There is in point of fact no comparison between the occurrence of either game or fly in the area at the present time and the prevalence of both preceding and during the first year of the experiment. From previous experience there was every reason to anticipate increase and further spread of the pest under the conditions obtaining before the experiment was started. Instead of this there has been very marked diminution and, as far as can be ascertained, considerable retrogression of the fly. That this has been brought about by the decimation and harassing of the game is beyond any reasonable doubt.

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# Tobacco Culture.

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## THE HARVESTING AND CURING OF VIRGINIA TOBACCO.

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By H. W. TAYLOR, B.Agr., Tobacco and Cotton Expert.

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[This article appeared originally in the *Rhodesia Agricultural Journal* for December, 1919. It has been revised slightly, and is reprinted now in response to the considerable demand for information on the subject. The article will later be available in bulletin form, and a copy can be obtained upon application.—Ed., R.A.J.]

Harvesting and curing are the two most critical operations in tobacco production. Mistakes in either operation cannot be rectified and may mean serious financial loss to the grower. Successful curing depends on a number of factors, of which one of the most important is the stage of ripeness of the leaf when harvested. Unless the leaf is properly ripe it is next to impossible to cure tobacco a satisfactory colour. If harvested before the proper time, the leaf retains the green colour after it is cured, and if harvested too late, the over-ripe leaf is uneven in colour, brittle and lacking in elasticity and fineness.

The stage at which tobacco should be harvested depends to some extent on the method of curing. If the tobacco is to be air cured or sun cured, the leaf should be harvested just before it is thoroughly ripe. For flue curing and fire curing the tobacco should be fully ripe.

### RIPENING.

The young growing tobacco plant has a deep green colour, and the leaves are soft and pliable. This intense green colour indicates that the leaf is rich in nitrogenous constituents, which go to make up the living or vital parts of the leaf, and which are active in building up the food supply of the plant. Garner\* states that "at about the time the leaves of the plant as a whole have reached their maximum power of elaborating the food supply the flower head begins to develop. This food supply, consisting of starch and other similar substances, is carried from the leaf into the seed head to furnish the necessary food for the development of the seed. This accomplished, the leaves have completed their

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\*Bulletin No. 143, U.S.D.A. Bureau of Plant Industry.

full task, and they now pass into the period of gradual decay. In practice, however, the plant is topped, so that the seeds are not allowed to develop. Making a last effort to reproduce itself, the plant now sends out secondary shoots or suckers, but these too are removed by the grower. Under these circumstances the food built up by the leaves is not carried away to other parts of the plant, but accumulates in the leaves themselves. The result is that both the size and body of the leaf are increased." This accumulation of plant food in the leaf induces ripeness and later decay unless the leaves are removed. The lower and middle leaves should be ripe in about 90 days from the date of transplanting, provided the plants make normal progress.

The principal indication of ripeness is a decided change in colour. As the leaf approaches maturity there is a gradual change of colour from a deep green to a greenish-yellow. If the leaf is heavy in texture the yellow may only show in flecks or spots. Another indication of ripeness is the change in texture of the leaf from being soft and pliable to being rough to the touch and brittle. This is due to the accumulation of starch granules within the leaf cells.

The chief secret in curing tobacco successfully lies in knowing exactly when to harvest the leaves, so that they are neither too ripe nor too green. This can only be learned by experience and keen observation. For flue curing the leaf should take on a greenish yellow colour when fully ripe, so that the green colour is reduced to a minimum before the tobacco is placed in the curing barn.

### HARVESTING.

There are two methods of harvesting tobacco, known as the whole plant and single leaf methods, and each has its advantages. The former is the more economical method of harvesting tobacco for air curing, sun curing or fire curing, but has the disadvantage in that all of the leaves on the plants are not in the same stage of ripeness. For flue curing the single leaf method is generally used, as it is of the utmost importance that all of the leaf should be in the same stage of ripeness.

In harvesting the whole plant the easiest way is to split the stalk with a tobacco knife to within about 4 inches of the ground. The stalk is then slightly bent away from the operator and severed near the ground by a sloping cut. The plant is then placed astride a tobacco stick, which will carry from six to ten plants. These sticks are placed on a tobacco frame or tobacco trolley (see Fig. 1) and carted to the curing barn or scaffolds in the sun. An ordinary wagon can be used for carting the filled sticks by providing a suitable frame (see Fig. 2).

In Rhodesia most of the Virginia tobacco is flue cured. For this method of curing the single leaf method of harvesting should be used, as successful curing largely depends on having all of the leaf in a barn in the same stage of ripeness. If the tobacco varies in the stage of ripeness all of the leaf will not yellow at the same time, and hence will not be uniform in colour when cured. For flue curing the leaf used for

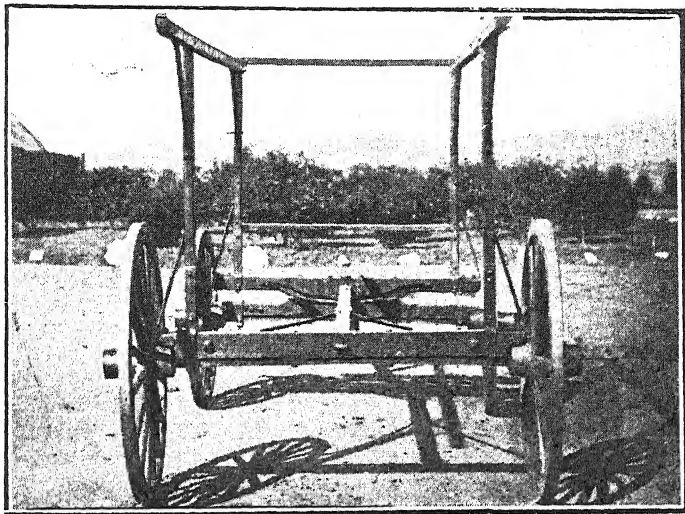


Fig. 1. Trolley for carting sticks filled with tobacco.

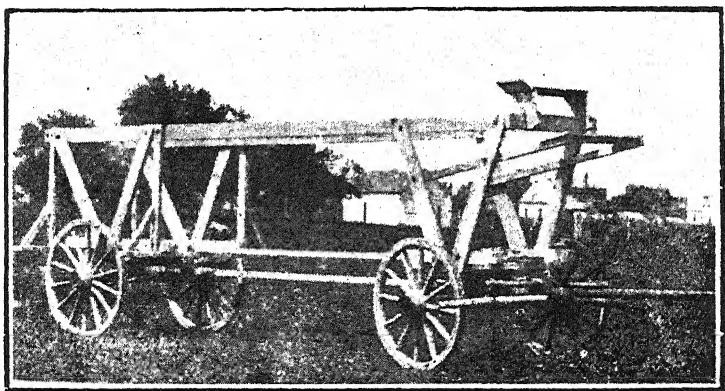


Fig. 2. Ordinary wagon with suitable frame for carting sticks filled with tobacco.





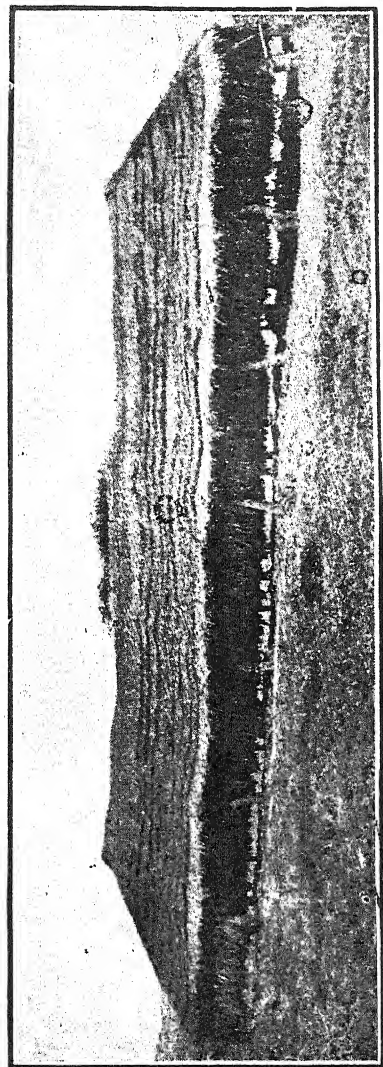


Fig. 3. Air-curing shed, Transvaal.





each barn should be of uniform texture for the same reason. Lack of supervision in these details is annually the cause of serious loss to tobacco growers in Southern Rhodesia. In harvesting by the single leaf method the first leaves to be removed are the lower ones and the last the top leaves. Generally the most valuable tobacco is obtained from the bottom and middle leaves. The number of pickings required to harvest a field depends largely on the growth of the plant, but from three to five pickings are usually necessary to obtain the best results.

As the leaves are primed from the plants they are placed carefully in suitable containers and conveyed to the stringing shed. In handling the leaf care should be taken so that no bruising takes place, and on hot days some form of covering should be provided to prevent sun-burn. Both the bruised and sun-burned portions of leaves cure out with a greenish black discoloration which greatly reduces the value of the tobacco. In harvesting the strictest supervision should be exercised in order that all leaves picked may be in the same stage of ripeness and of uniform texture. In the stringing shed the tobacco is placed on tables or in small piles within easy reach of the natives employed in tying. The tobacco is placed in bunches of three to four leaves each and tied with a cotton string which is attached to the tobacco stick. The operation of tying is greatly facilitated by having convenient racks for supporting the sticks and placing the leaves in uniform piles with the butts all in one direction. The operator holds the string in the right hand and receives the bunch of leaves with the left hand. The leaves are placed close to the stick, and the string is wrapped round them, one half inch from the base, one and one-half times, away from the operator, and then turned completely over and across the stick, which operation forms a draw twist. The next bunch of leaves is placed on the opposite side of the stick so that the alternate bunches will balance the filled stick. When the stick is filled the free end of the string is attached to the end of the stick and the tobacco is placed in the curing barn. When properly filled, each stick should hold about 32 bunches of leaves; about 16 bunches on either side.

### CURING.

Tobacco when harvested contains from 70 to 80 per cent. of moisture. The most noticeable change which takes place in curing is the gradual reduction of the moisture contained in the leaf. Curing, however, involves more than the drying of tobacco, for if the cells of the leaf are quickly killed by excessive heat or protoplasmic poisons, the product does not possess the properties associated with properly cured tobacco.

During the curing process certain chemical and physiological changes take place which convert or reduce the undesirable constituents of the green leaf into desirable forms found in properly cured tobacco. These changes are gradually brought about during the process of slow starvation to which the leaf is subjected after harvesting. Curing then consists in subjecting the tobacco to a process of gradual starvation under proper conditions.

The principal factors which control the rate of curing are heat and moisture. As there are several methods of curing tobacco, the conditions which are most suitable for one method may not be applicable to another.

**Methods of Curing.**—The soil and climatic conditions under which the crop is grown and the purpose for which the tobacco is to be used largely determine the method used for curing. The several tobacco-growing countries therefore employ methods of curing to meet their market requirements and individual economic conditions. The diagram given below indicates the several methods of curing and the types of tobacco cured by each method.

|                   |                                                                               |                                                                |
|-------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------|
| <i>Air cured</i>  | { Cigar tobacco<br>Burley<br>Stemming<br>Transvaal tobacco }                  | { Cigars, pipe mixtures,<br>chewing, snuff and<br>cigarettes } |
| <i>Sun cured</i>  | { Turkish<br>Maryland<br>Virginia<br>Rhodesia }                               | { Cigarettes, smoking<br>and chewing }                         |
| <i>Fire cured</i> | { Virginia dark<br>Kentucky dark<br>Tennessee dark<br>Nyasaland dark }        | { Chewing, smoking,<br>snuff and cheap<br>cigars }             |
| <i>Flue cured</i> | { Virginia bright<br>Carolina bright<br>Nyasaland bright<br>Rhodesia bright } | { Cigarettes, pipe mix-<br>tures, chewing and<br>snuff }       |

**Air Curing.**—This method of curing is more generally used than any other, and the greater part of the tobacco produced in the world is air cured. It is also the simplest and easiest method which can be employed, as the usual practice is to place the tobacco in the curing barn, where it remains until thoroughly cured and ready for preparation for market.

Air curing may be described as a natural process of curing, as the tobacco is merely harvested, placed in the barns and allowed to cure by natural atmospheric conditions. If the weather conditions are ideal, good results are obtained, but if wet weather prevails, severe loss may result from "pole sweat." On the other hand, should excessively dry, hot windy weather occur immediately after harvesting, the leaf may be killed prematurely, which greatly reduces the value of the tobacco. In recent years air curing has, in certain tobacco-producing areas, been modified by the use of artificial heat and moisture, which enables the growers to regulate curing conditions and thus prevent loss after the crop is harvested.

The conditions most suitable for air curing are clear, calm days, moderately dry atmosphere and a temperature of 80° to 90° F. in the shade. Under these conditions the moisture is absorbed by the atmosphere as fast as it is given off from the leaf, and very little oxidation takes place, excepting in wet weather, so that the leaf cures moderately bright in colour.

Normally all tobacco should take on a yellow colour before it begins to dry. If the tobacco dries out before the yellow colour appears, the leaf

will remain green and be of little value. If drying is delayed after the yellow colour appears, oxidation takes place and the colour will change to red or brown. The purpose for which the tobacco is to be used largely determines the proper colour for the cured leaf. For cigarette purposes the leaf should be lemon yellow in colour; for cigars the most desirable colours are shades of brown and olive; for chewing purposes and pipe mixtures a light red colour is most desired. The conditions of curing then should be regulated to produce tobacco most suitable for local market requirements. The time required for air curing varies from six weeks to three months, depending primarily on weather conditions, but also on the size of the tobacco being handled.

In the Union of South Africa the buildings used for air curing (see Fig. 3) are very primitive in construction, but in other countries (see Fig. 4) where this method of curing is practised, the tobacco barns are very costly and elaborate. Cigar tobacco, burley tobacco, the tobacco known as the "stemming type," and most of the tobacco produced in the Union of South Africa, are cured by this method. As these types of tobacco are not grown in Southern Rhodesia, air curing is not recommended as a suitable method for curing Rhodesian grown Virginia tobacco. The reasons why air curing is not recommended are as follows: Firstly, there is very little local demand for air cured tobacco, as the Union of South Africa can produce as much tobacco of this type as can be consumed in South Africa, and the prices in the Union are considerably lower than the prices ruling in this Territory for sun and flue cured tobaccos; secondly, the demand within the British Isles and Australia is not rapidly increasing for this type of tobacco; and, thirdly, the climatic conditions in Rhodesia during the early part of the curing season are not conducive to the best results without the use of costly and elaborate buildings for air curing.

**Sun Curing.**—Turkish tobacco is sun cured, and this method is also employed in certain parts of America. Sun curing is similar to air curing in that no artificial heat is employed to facilitate curing. The two methods differ in that curing is hastened by exposing the leaf to the direct rays of the sun in the one, whilst in the other the rate of curing is largely regulated by atmospheric conditions.

For sun curing the equipment required consists of a wilting room and packing shed, scaffolds or trellises for exposing the leaf to the sun, and a conditioning cellar for rendering the leaf pliable so that it can be prepared for market. The building described in the issue of the *Rhodesia Agricultural Journal* for October, 1921, as a packing shed with conditioning cellar can be used for wilting, storing and conditioning tobacco. The scaffolds or trellises can be made entirely from native timber or with native timber and heavy galvanised wire.

In sun curing the whole plant is usually harvested, but the single leaf method can be used when sun and flue curing are combined. The usual method of sun curing embraces the following operations: The tobacco is harvested just before it is fully ripe and placed on sticks in the wilting room until the leaf takes on a greenish yellow colour. If no wilting room is available the tobacco can be yellowed under grass,

but requires careful attention to avoid damage through the leaf becoming too warm and turning black. When the leaf is properly yellowed it is removed to the scaffolds and exposed to the sun until the whole leaf, including the midrib, is thoroughly dry. During this time some form of covering should be provided to protect the tobacco from rain and from dew at nights. For this purpose sail cloth, hessian or grass mats can be used. The coverings are placed in position at night or during showers, and are removed in the early morning or after showers have passed to allow the tobacco to receive the full rays of the sun. When the leaf is thoroughly dry, the tobacco is removed in the early morning to the conditioning cellar, where it remains until the leaf is pliable, when the tobacco is graded and either bulked or baled for marketing. The time required for sun curing varies from four to six weeks, depending on climatic conditions and the size of the leaf being cured.

Growers who practise sun curing should time their plantings so that the tobacco will be ready for harvesting about the time that the rains normally cease. This will save considerable trouble and expense, besides aiding in the production of better quality tobacco.

Sun cured tobacco of the Virginia type possesses certain desirable qualities as compared with air cured leaf. Leaf cured by this method is usually lighter and more uniform in colour, as well as sweeter and more aromatic. Sun cured tobacco is desirable for chewing and for pipe mixtures.

This method of curing can be recommended for certain areas where only heavy tobacco can be produced, and is especially useful in connection with flue curing. Unless tobacco yellows in the field it is extremely difficult to obtain a satisfactory cure in the flue barn. The leaf which is heavy, oily and unsuitable for flue curing can be sun cured until the web of the leaf is dry and the midrib can then be killed in the flue barn. The combination of the two methods reduces the time required for curing, and produces a more desirable product.

**Fire Curing.**—In this method artificial heat is used to hasten curing as well as to develop the characteristic flavour and aroma of fire cured tobacco. As the name implies, heat is applied by means of open fires directly beneath the tobacco. The smoke from the burning wood imparts a creosotic flavour and a particular aroma, and at the same time improves the keeping quality of the cured product. Tobacco cured by means of open fires is greatly in favour in Europe, where it is used for various manufacturing purposes. There is also a considerable demand for this type of leaf on the West Coast of Africa, but there is no local demand.

For fire curing, tobacco should be heavy in body, smooth in texture, with large oily leaf and rich in nitrogenous constituents (Fig. 5). The soil for the production of tobacco suitable for fire curing should be well drained, naturally fertile, and the growth of the plants is further increased by heavy applications of manure or fertilisers. The plants are topped low so that only large leaf is produced, and the tobacco should be allowed to become fully ripe before harvesting.

The whole plant is harvested and placed on sticks in the field. After the tobacco has slightly wilted it is carted to the curing barn and hung in tiers with the sticks of tobacco about 6 inches apart. No fires are started until the leaf yellows, which requires from four to six days. Small fires are then made at intervals on the floor of the barn, and the temperature is slowly increased to 90° F. during the first 24 hours. The temperature is then gradually raised, by regulating the fires, to about 125° F. in three to four days, when the web of the leaf should be partially dry. The fires are then removed and the leaf allowed to become pliable through the moisture spreading from the midrib through the leaf web. Fires are then re-started, and the leaf again dried. This operation is repeated until the leaf, including the midrib, is thoroughly cured. The leaf is then brought into condition, stripped from the stalk, graded and either bulked or baled. In fire curing care must be taken not to increase the temperature too rapidly in the early stages, or the leaf will dry prematurely and be of little value. From two to three weeks are required to effect a proper cure by this method. The barns for fire curing are usually small (Fig. 6), so that they can be easily filled with tobacco of uniform ripeness, simple in construction and inexpensive.

The amount of soil in Southern Rhodesia suitable for the production of tobacco of this type is limited, so that this method of curing will probably not be used to any extent in this Territory.

**Flue Curing.**—In this method, which is recommended for this Territory, the rate of curing is regulated by the use of artificial heat, which is distributed by flues passing around and through the inside of the curing barn. For plans and specifications of flue barns see the number of the *Rhodesia Agricultural Journal* for October, 1921. The heat is generated by wood fires in furnaces, and radiates from the flues, so that the flavour and aroma of the leaf is not influenced or contaminated by smoke as in fire curing. Heat is applied continuously from the time curing is commenced until all of the leaf in the barn is thoroughly dry.

Flue curing is the most modern and scientific method of curing tobacco, and requires careful attention to each detail. Good tobacco can be completely ruined in the curing process, while leaf of apparently poor quality can be considerably increased in value through skilful curing. The colour most desired in flue cured tobacco is a lemon yellow, as this grade of tobacco is greatly in demand and realises the highest prices. In any crop of tobacco, however, the cured leaf will show all colours from bright yellow to dark brown. Green is the colour least desired, and care should be taken to so regulate the curing that leaf of this class will be reduced to a minimum.

In flue curing the aim of the tobacco grower is to hasten the yellowing of the leaf, and when the proper yellow colour is obtained to cure out the tobacco so that it still retains the desired colour. To secure this end five things are necessary:—(1) Suitable soil, (2) proper cultural operations, (3) suitable climatic conditions during the growing season, (4) the leaf to be harvested at the proper stage of ripeness, (5) correct management of the barn during curing.

Many formulas have been given for curing tobacco by this method, and any one of them is correct under certain conditions; but, unfortunately, it is not possible to alter all conditions to suit any particular formula. Tobacco grown on different types of soil, and often tobacco grown on different parts of the same field, requires different periods of time to yellow and to dry out. The same applies to the leaf harvested at different periods from the same plants on any given soil. It can, therefore, be seen that the formula which is correct in one case would be slightly wrong in another. Although no fixed and definite formula can be laid down, it is possible to give some general directions which, with good judgment, the grower can modify to suit his particular conditions. In flue curing tobacco which has been harvested by the single leaf method there are three stages to be observed, viz., yellowing the leaf, fixing the colour, and drying the leaf and midrib. If the whole plant is harvested a further stage is required to kill the stalk.

*Yellowing.*—The barn should be filled in one day with leaf of the same texture and in the same stage of ripeness, so that all of the leaf in the barn will yellow at practically the same time. When filled, the barn should be tightly closed to prevent the escape of moisture, and a small fire started in each furnace. When the fires are started a thermometer and hygrometer are placed in the centre of the barn on a level with the first or lower tier of tobacco. The hygrometer is used to indicate the amount of moisture in the atmosphere of the barn, and is of great assistance during this stage of curing.

At first only small fires are required, but these are gradually increased until the thermometer registers about 90° F. It is imperative that low temperatures be maintained at first, as high temperatures would kill the leaf prematurely before it changed from green to a yellow colour; tobacco so treated has practically no value. A temperature of 90° F. is maintained until the leaf begins to yellow around the edges and at the tips, when the heat is raised to 95° F. and held until the colour begins to spread. The temperature is then increased to 100° F. until the yellow colour becomes more pronounced. During this time the atmosphere of the barn should be kept moist to prevent the leaf from drying. This is when the hygrometer is invaluable. Enough moisture must be kept in the atmosphere of the barn during this period, so that the temperature registered by the wet bulb of the hygrometer will not be more than 3° to 4° below that registered by the dry bulb. If a depression of 3° could be maintained the leaf would yellow more rapidly and more uniformly. When the wet bulb registers more than 4° below the dry bulb, it indicates that the atmosphere in the barn is becoming too dry and artificial moisture must be introduced into the barn. This can be done by wetting the walls below the tobacco, by pouring water over the floor, or by placing wet bags on the flues. When the leaf begins to show a distinctly yellow colour the temperature is increased to 110° F. and held until the leaf is practically yellow, when the heat is raised to 115° F. and held until the leaf takes on the proper yellow colour. From 100° F. to 115° F. the amount of moisture in the atmosphere of the barn is reduced until the wet bulb registers from 6° to 7° below the dry bulb.

*Fixing the Colour.*—When the tobacco is properly yellowed the barn



must be so managed that no further change of colour takes place in the leaf. This is the critical stage in curing, and requires the closest attention and the most careful manipulation. If the atmosphere of the barn is too humid, or if the ventilation is not sufficient, and the temperature is not increased fast enough, moisture will collect on the surface of the leaf and the tobacco will turn a reddish brown colour, or "sponge," which decreases its value. On the other hand, if too much ventilation is given, and the temperature is increased too rapidly, the leaf will be killed too quickly and a greenish red or black colour will develop, which greatly reduces the value of the leaf. The proper conditions are maintained when the barn is so ventilated that the moisture is carried off as fast as it comes to the surface of the leaf, and the temperature is so regulated that the colour will be fixed in 15 to 18 hours.

To secure these conditions the bottom and top ventilators should be slightly opened and the fires increased to maintain the temperature at 115° F. The ventilation and heat are increased and the temperature kept at 115° F. until the tips of the leaves begin to curl, when the temperature is increased to 120° F. and held until the leaf begins to dry. This condition is indicated by the leaves curling in towards the midrib. The temperature is then increased to 125° F. and held until the leaf appears to be dry, when the colour will be fixed.

*Drying the Leaf.*—To dry the leaf thoroughly the temperature is increased to 130° F. in two hours and held at this point for about four hours and then raised to 135° F. in one hour and held for four hours, when the web of the leaf should be quite dry. The ventilation is then reduced and the temperature increased about 5° per hour up to 160° F. and held at that point until the midrib is dry enough to snap when bent between the fingers. If the whole plant is being cured the temperature should be increased to 180° F. and kept for eight to ten hours to dry out the stalk thoroughly. Growers should keep in mind the fact that excessively high temperatures have a detrimental effect upon the texture of the cured product. Excessive heat renders the leaf brittle, and the tobacco lacks the soft, silky touch desired in high grade cigarette leaf. High temperatures also tend to somewhat destroy the bright, lively colour of properly cured tobacco. For the best results, when tobacco has been harvested by the single leaf method, the temperature should not exceed 160° F.

From four to six days are required to cure a barn, depending principally on the length of time required for the tobacco to yellow. The above temperatures are only given to serve as a guide, and each grower must modify them to suit the conditions which, according to his judgment, are existing at the time he is curing.

It might be well to point out that the rate of curing is influenced considerably by the temperature of the outside atmosphere, which replaces the air in the barn during ventilation. It will be found that higher temperatures are required in wet weather than in dry weather, and that lower temperatures are required in cool weather than in warm weather. The condition of the atmosphere outside of the curing barn has also to be considered in regulating the ventilation during the time

the colour of the leaf is being fixed. If the atmosphere is very dry, the amount of ventilation should be reduced and the top ventilation should be decreased to the minimum to prevent the tobacco from drying too quickly. During excessively wet weather the reverse conditions prevail and bottom ventilation should be reduced and the top ventilation increased, in order that the moist atmosphere may be driven out of the barn.

**Management after Curing.**—Regardless of the method used in curing, tobacco can be either increased or decreased in value by the method of handling employed after the leaf is cured. If properly handled the colour and quality of the leaf will improve, but if improperly handled considerable loss must occur.

The method of handling tobacco in Southern Rhodesia is peculiar to this Territory. When the tobacco is cured the leaf is brought into condition, baled without regard to size, colour or quality of leaf, and despatched to a warehouse, where it is graded and prepared for market. This system is comparatively simple from the growers' point of view, but is radically wrong in many respects. In the first place tobacco does not improve in colour and quality when baled direct from the barn, as it should if bulked in proper condition on the farm. Secondly, the grower does not see his errors in curing and growing the crop, as he would if the leaf were graded and handled on the farm, and hence does not learn from his mistakes. Thirdly, if tobacco growing develops into an industry of considerable proportions, as it should do, the warehouse organisation must reach abnormally large proportions to deal with the leaf produced.

The proper method of handling tobacco is to bring the leaf into condition after curing and place it in bulks or stacks, of convenient length and width and about 6 feet high. Bulking can either be done with the leaf on the stick or by removing the leaf. In either case the leaf should be roughly graded and the leaf of different colours and texture placed in separate bulks. The bulks of tobacco should be carefully watched, and should the leaf begin to heat or mildew through being in too high condition the tobacco should be re-bulked.

For handling tobacco in this manner a packing shed with conditioning cellar, similar to that shown in the issue of the *Rhodesia Agricultural Journal* for October, 1921, should be provided. The shed would be used for bulking and grading and the cellar for conditioning the leaf. The size of the building would naturally be altered to suit the requirements of the individual grower. If the grower preferred to use steam for conditioning tobacco, the cellar could be dispensed with and a room suitable for this purpose would be provided. The method of handling tobacco under this system is as follows:—As the tobacco is cured it is bulked until curing is completed. Each stack should be examined at regular intervals to ascertain the condition of the leaf, and if in too high condition the bulk must be turned. After curing is finished the tobacco first cured would be graded and either re-bulked or baled. Any leaf from the bulks which was too dry for handling would be lowered into the cellar or placed in the steaming room to be brought into proper

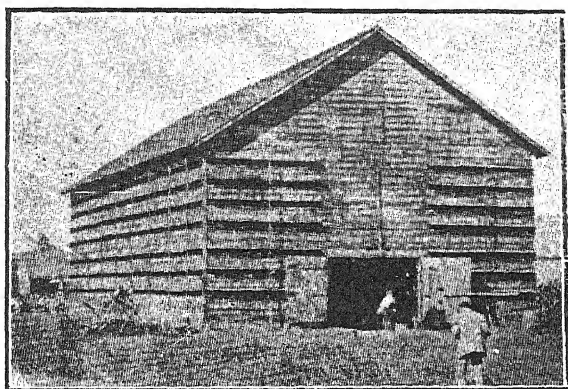


Fig. 4. Type of barn used for air curing in America.

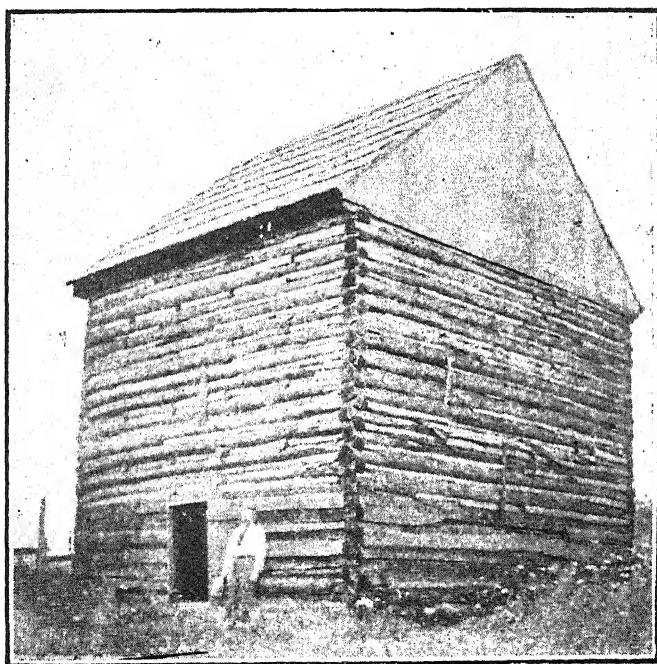


Fig. 6. Curing barn for dark fire-cured tobacco.



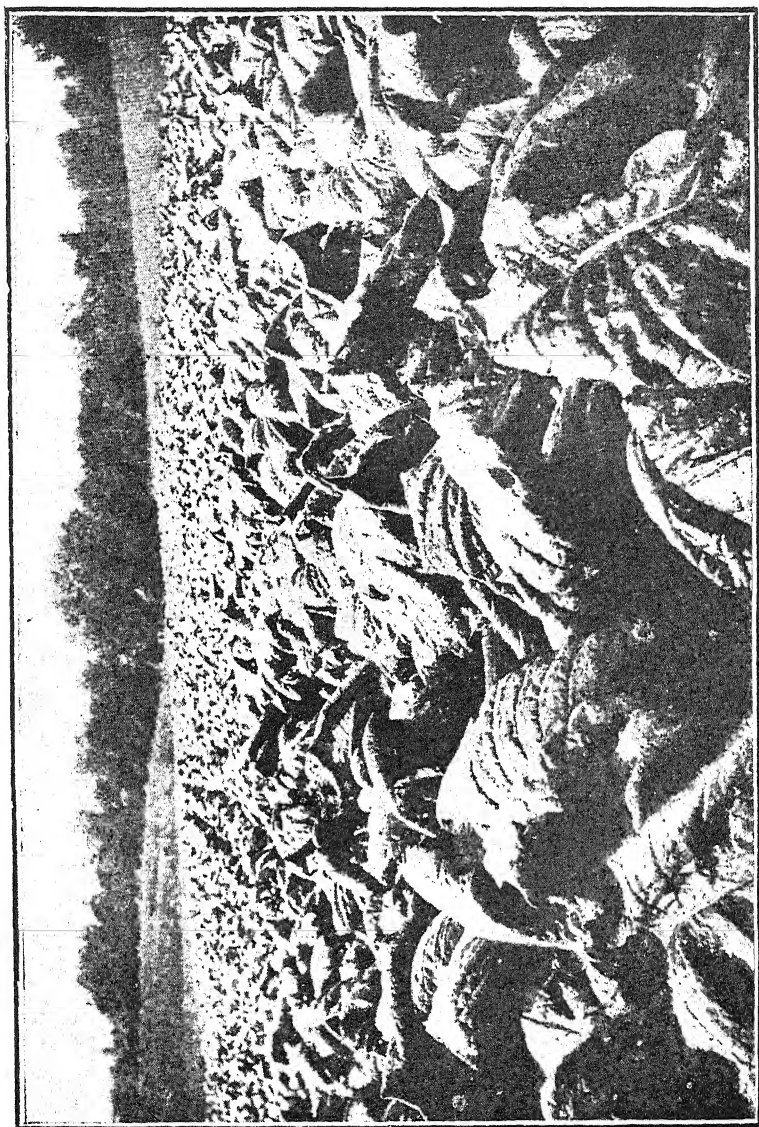


Fig. 5. Dark fire-cured tobacco.



condition. In grading the leaf would be sorted into the several grades of brights, mediums and darks. Damaged, perished or green leaf would be placed in separate grades. After grading was finished or when sufficient leaf of each grade was ready, the tobacco would be packed for market. In preparing the leaf for market, each package should contain only one grade of tobacco.

Leaf which is harvested ripe but cures out with a greenish colour can be greatly increased in value by this method of handling, as bulking removes the green colour and improves the aroma of the tobacco. Bulking also tends to develop a uniform colour in leaf which is lacking in this respect. Care must be taken in bulking tobacco to obtain the best results. If the tobacco is too dry, the leaf does not improve as it should, and if too moist mildew may develop, or the bright leaf may become darker in colour. When in proper condition for bulking or baling, the web of the leaf and lower half of the midrib, from the tip to the butt, should be supple, but the upper half of the midrib should be only slightly pliable.

With the present system of handling, there is annually a considerable loss through bad handling before the tobacco reaches the warehouse for grading and marketing. The latter institution is usually blamed for this loss, through mismanagement, whereas the loss is usually due to carelessness on the part of the grower. The misunderstandings which result lead to friction between the parties concerned, without preventing a repetition of the troubles which handicap the industry. Proper handling of the tobacco on the farms, including grading and preparation for market, would be both educational and remunerative to the grower, and would greatly assist in establishing the tobacco industry on a sound economic basis.

## The Management of Sheep.

By MONTAGUE GADD, Springfield, Tafelberg, Cape Province.

[The following article will, we are sure, be extremely helpful to those who contemplate the breeding of sheep in Rhodesia. It will be recalled that Mr. Gadd, who is a successful sheep farmer in the Union of long experience, attended the recent shows at Bulawayo and Salisbury and exhibited Persian sheep of his breeding. These sheep, which were much admired, were afterwards sold locally.—Ed., *R.A.J.*]

**Introductory.**—When in Rhodesia recently I promised to write a few notes on the management of sheep for the information and guidance of those of my brother farmers who have made or intend making a start with Persian sheep. This article is written in fulfilment of that promise, with a hope that it may be found useful to those who have not had experience of sheep management in that part of South Africa.

I need hardly say that, in so far as sheep farming is concerned, Rhodesia is practically an unknown quantity, and that those who take up sheep farming there have a lot of pioneering work in front of them; but from what I have seen of Rhodesian-bred sheep, I am convinced that throughout a large area of Rhodesia many farmers will be able to make a success of sheep if kept in not too large numbers and proper care and attention are devoted to them. That being so, the reader will understand that what I have to say should be taken as a basis on which their judgment, formed on the result of future experience, must build, rather than the one and only practice that should be followed.

**Type of Grazing.**—The first point to which I refer is the fact that if a few sheep are kept round a homestead of the Rhodesian farm they do remarkably well, but when it is attempted to keep larger numbers away from the homestead they are not nearly so successful. Here we have the fundamental necessity of sheep farming set out very clearly indeed. Round the homestead the grass is usually "tramped" and more heavily grazed, and is consequently short, sweet and soft; away from it long, hard and more sour. In other words, sheep must have short pasture, and one may say the shorter the better. The first step towards getting short pasture is to select the most suitable area on the farm and divide it by fences into paddocks of, say, from 200 to 400 acres. The number of paddocks required will of course depend



upon the number of sheep to be kept. The purpose of the paddock is to confine the stock to a small area at a time. First of all the paddock is well grazed down by cattle. When that has been done and the cattle removed, the sheep are put into it and kept there until they have literally eaten the grass down into the ground. While they are doing this, the cattle will be preparing a second camp for them; and so the process of grazing, first by cattle and then by sheep, goes on year in and year out to the benefit of both beast and sheep, for not only does the sheep get the short pasture it requires, but the pasture itself, owing to this process of close or thorough grazing, becomes sweet. The well known saying, "The nearer the bone the sweeter the meat," may well be applied to "The nearer the root the sweeter the grass." If the grass cannot be kept short by grazing, mowing should be resorted to as an aid to grazing by cattle.

**Green Feed.**—As much green feed as possible should be provided for the lambing season. It promotes the flow of milk and is also very beneficial to the growing lamb. Where possible, therefore, for this purpose sow oats, speltz, rye or barley in the early autumn. I would also strongly recommend the planting of the Burbank spineless cactus, that is, the spineless prickly pear and the American aloe (Agave).

**Water.**—Another important matter is drinking water, which is often the cause of conveying disease and parasites to sheep. On no account should they be allowed to graze in marshy places or drink from stagnant pools. Undoubtedly the best supply is that pumped from a well or borehole. In this case the best and cheapest arrangement is the reinforced concrete reservoir, with its drinking trough all round it, at the base, this latter automatically kept filled from the former by means of a ball valve.

**Kraaling.**—Sheep are far healthier when running day and night than when kraaled, but this necessitates vermin-proof fencing to keep out destructive carnivora, and more than repays the extra expense. If the sheep are kraaled, however, care must be taken not to overcrowd, and it is desirable to provide shelter of some kind in excessively rainy weather, whether kraaled or not.

**Shearing.**—The Woolled Persian should be shorn at least twice a year; four times would be better if grass seed is troublesome, as will be the case where the veld is not kept short.

**Dipping.**—It is very beneficial to run the smooth-coated Blackhead Persian through the cattle dip fortnightly; also the Woolled Persian after shearing and so long as its coat is not too long to permit of dipping. Sometimes sheep are troubled with ticks on the feet. In such cases it is advisable to run them through a foot bath of dip, say, on their way to or from the kraal.

**Docking Lambs' Tails.**—It is not necessary to dock the tails of Blackhead Persians, but this must be done in the case of Woolled Persian *ewe* lambs when they are from eight to fourteen days old. One man or boy holds the lamb and squeezes the root of the tail between

the forefinger and thumb, while another cuts off the tail with a sharp knife about the second joint from the root of the tail. Should the blood spurt out, the root of the tail should be held firmly for a minute or two to stop loss of blood. To do this is not always necessary, since in most cases there is not excessive bleeding.

**Diseases and Salt Licks.**—The control of disease is an important item in the successful management of sheep, and here it is that the farmer must be ever watchful; and let me say at once it is better to prevent than to have to cure. Among other things, a lick made up almost entirely of salt, but containing small quantities of bicarbonate of soda, Epsom salts, flowers of sulphur, powdered sulphate of iron and powdered gentian root, is recommended, and it is claimed that such a lick supplies sheep with certain ingredients which are frequently not present in sufficient quantity in their food, as well as acts as a direct preventive of worm troubles, to which sheep are very liable. In parts of Australia, where internal parasites at one time were very troublesome, they have now been entirely eliminated by a regular supply of the above lick. ("Management and Diseases of Sheep in Australia," published by Butterworth & Co., of Sydney, New South Wales.)

The general practice is to give a salt and Kerol lick (a quart bottle of Kerol thoroughly mixed with about 75 lbs. of salt), and if a sheep shows signs of seediness, a teaspoonful of pure Kerol or Little's Dip is given two or three days in succession if necessary, but on *no account* should either of these substances be given with water.

**Tapeworm.**—Lambs usually begin to suffer from tapeworm, which is to be found in the intestines, at from two to three months old and even earlier, and a constant look-out must be kept for signs of this trouble, which are a general unthriftiness accompanied by purging. For clearing out tapeworm give double the dose of pure Cooper's dipping powder as prescribed in the wireworm cure. That is, where a particular spoon is prescribed for lambs of a certain age for dosing for wireworm, use just double the quantity of Cooper's powder for tapeworm. Whether dosing for wireworm or tapeworm, it is essential to starve for 18 hours prior to dosing, and water should not be given the same day as dosing. Dogs suffering from tapeworm are a considerable source of danger to sheep, and should therefore be kept free from them, and native dogs especially should not be allowed on the grazing ground of sheep.

**Wireworm.**—Wireworm is a very small thin worm about half an inch long, which invades the fourth or true stomach of the sheep. The best treatment for this is the Union Government wireworm remedy, issued to us, with full instructions, together with special dish and spoons, at a cost of 1s. 6d. per 100 adult sheep. The dish and spoons are extra, but these, with care, last a long time. This worm, like the tapeworm, is responsible for much unthriftiness, and its ravages often lead to death in times of food scarcity. I recommend that every sheep slaughtered on the farm and every sheep that dies be examined

for worms. By this means a farmer is enabled to know exactly in what state of health his sheep are as far as worms are concerned.

**Blowfly.**—The blowfly is a pest which has begun seriously to trouble Merino sheep in South Africa. It is stated in the book mentioned above that where sheep have constant access to the medicated salt lick referred to they are not affected by blowfly; whether that is so or not I cannot say, but this I can say, namely, that I have never had any blowfly trouble with either breed of Persian sheep, although Merinos alongside them are constantly struck. With a view to keeping down the blowfly, more especially in a young country, it should be the duty of every farmer to see that every animal that dies be buried immediately.

**Blue Tongue.**—Blue tongue is a fever caused through the bite of a nocturnal insect (mosquito?) which usually troubles in the rainy summer months. The best treatment for this disease is preventive inoculation, particulars concerning which should be obtained from the Veterinary Department. Blackhead Persian sheep are practically immune from this trouble in these parts, and the Woolled Persian are not seriously affected. Shedding at night is very helpful in this trouble.

**Conclusion.**—In conclusion I would say that I hope that these few notes will prove of some assistance to those for whom they are written; also that I shall be pleased at all times to answer queries concerning the management of Persian sheep so far as I am able.

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[The following are a few notes written by Mr. J. Cole Rous, Stradbroke, Tafelberg, C.P., who farmed with sheep in the Transvaal under somewhat similar conditions as obtain in Rhodesia.]

If, when I started sheep farming in the Transvaal just after the Boer War, I had had Mr. Gadd's notes on the subject, I would probably have become established as a sheep farmer up there many years before success eventually came to me. Instead of which I had to peg away without intelligent help or advice, with the result that for years I was carrying out a series of "field experiments" at my own expense, which is a job for a Government Department, not for a struggling farmer. However, at Mr. Gadd's request I am writing a few notes on the conclusions at which I eventually arrived on the subject of sheep farming in the Transvaal, where the conditions are not dissimilar from the Rhodesian conditions.

My experience was gained first in the North Pretoria district and later in the Middelburg district, where the rainfall is from 28 to 30 inches and occasionally up to 36 inches per annum. Neither of these localities is regarded as being suitable for sheep all the year round, but is used as change grazing by the "trek Boers" for autumn and spring feeding. As I was not in a position to "trek farm," I had to use my veld all the year round. After some heart-breaking experiences I found that sheep would not thrive on rank long grass.

The "trek Boers" overcame this difficulty by burning off patches of old veld in the late summer months. This old veld consisted of grass which had not been burnt off the previous winter, so that the old grass acted as fuel to burn off the then ripe grass of the last season's growth. This induces a false autumn growth of from two to four inches long which is much relished by the sheep in the autumn and early winter months, but it is hardly necessary for me to point out what a wasteful and pernicious practice this is. My own holding was only 1,200 morgen in size, and so too small to enable me to carry on any such wasteful method. But eventually realising the idea, I enclosed my farm and cut it up into small paddocks varying from 50 to 500 morgen, and also put down some blocks of *paspalum* grass as a change feed; this, if closely grazed, is a splendid sheep feed, but like any other grass, is useless when "rank."

The great difficulty was to graze the grass close enough to render it suitable for sheep, hence it is necessary to have the paddocks of such a size that the cattle at one's disposal can graze it down and prevent it from running to seed. When the first paddock is closely grazed by cattle, put in the sheep and pass the cattle on to the next paddock to prepare that. In from two to three months move the sheep on to No. 2 paddock and the cattle on to No. 3, and so on in rotation.

That grass country with a comparatively heavy rainfall and heavy dews is badly troubled with intestinal parasites, so it is necessary to dose once a month (28 days) and invariably dose the sheep before shifting from one paddock to the next. Avoid having a few stray sheep in the vacant paddocks. This is *important*; such stray sheep keep the parasitic infection alive in the veld. The whole secret of success with sheep in that area is—

- (1) Close grazing.
- (2) Periodical shifting to clean prepared veld.
- (3) Absolute control of intestinal parasites.
- (4) Constant watchfulness and care.

No. 3 is obtained by firstly giving effect to Nos. 1 and 2 above; secondly, by dosing as previously indicated; thirdly, by provision of a medicated lick, which should be placed in concrete or other mangers in every paddock; fourthly, by provision of a clean water supply.

As for a "medicated lick," the lick I used consisted of four buckets of salt, one bucket of fine bone meal, 10 lbs. of sulphate of iron, finely ground, all thoroughly mixed together. The manger was filled with this mixture, and I then poured Stockholm tar over the lot, stirring it up until the contents of the manger were nicely "browned." The sheep take to this readily, especially if the tar is left out at first until the animals get used to coming to the salt. The tar has a very healthy effect on the linings of the digestive tract, is a good vermicide, and prevents the animals from taking the salt too greedily, which they are apt to do in most grass countries.

I used to mate the rams with the ewes about the 25th of March, which brought the lambs at the beginning of September, at which

time a green shoot of grass may be expected. If a dry autumn has been experienced, put off the mating for two or three weeks. Of course, if green feed is provided for the lambs, the earlier they come the better, and in such cases autumn lambs may even be better than spring lambs. Before my holding was fenced and paddocked I felt that sheep farming in that area on the same farm continuously was practically hopeless. Sheep were unthrifty and I could not keep them free from worms, but paddocking put quite a different complexion on the whole business. My experience was gained with the Blackhead Persians. They stand climatic conditions well, are hardy, thrifty and adaptable. At a later date I got Merinos, which did very well under improved conditions herein outlined. On one occasion after I had paddocked I bought a lot of sheep in the Free State, paying 15s. apiece for them. They arrived in rather low condition. I re-sold the flock within the year, when their number was almost doubled by natural increase, and I sold them as they ran—lambs to count at 20s. per head. These lambs, though not more than six months old, were nearly as big as their mothers, and the mothers looked like fat wethers.

## Quinine Prophylaxis in Malaria.

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By A. M. FLEMING, C.M.G., M.B., C.M., F.R.C.S.E., D.P.H.,  
Medical Director.

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The following questions are frequently put to me by persons who are anxious to safeguard their own and their children's health and to avoid malaria at all cost: "Shall I take quinine as a preventive, and if so, when and in what doses? Is it wise and right to give quinine to children, and if so, in what form and how much?"

The proper reply to these anxious enquiries in most instances would be: "Avoid infection and you won't require quinine or any other drug"; but unfortunately there are cases and times when with the best intentions it is difficult or impossible to avoid being infected, and again there is always the risk of accidental infection to be considered.

It must at all times be clearly understood that the taking of quinine for the prevention of malaria can only be secondary to the infinitely more important measures for the avoidance of infection, namely, the destruction of mosquitoes, their habitats and breeding places, the living in mosquito-proof houses, and the constant use of mosquito curtains when in bed. The additional precaution of taking quinine as a preventive should be applied in particular to those persons who on account of their work or other unavoidable causes cannot adequately protect themselves, or to those who are liable to occasional and accidental infections.

There are two separate and distinct purposes for which quinine as a preventive is administered, viz., the prevention of primary attacks, and the prevention of relapses.

Dealing, firstly, with the prevention of primary attacks, there are three facts which must be noted:—

- (1) The younger the form of the malarial parasite the more susceptible it is to quinine, and the youngest form that can be so attacked is the minute thread-like organism or sporozoite which the infected anopheles injects into the blood stream when it is feeding.
- (2) Quinine when taken by mouth enters the circulation with great rapidity.
- (3) The feeding time of the anopheles mosquito is between sunset and dawn.

The aim, therefore, should be to have a certain amount of quinine

in the circulation when the mosquito bites, so that the sporozoite may be destroyed as soon as it is injected.

This can best be met by a dose of five grains of quinine at sunset, when, if a good mosquito net is used, theoretically there should be little or no danger of infection that night.

Quinine, however, is soon excreted from the blood stream, and if no net is used it is possible that if bitten by an infected mosquito towards morning, there will then be insufficient quinine remaining in the blood stream to destroy the infecting organism. If no net is available, or the net used is inadequate, in order to secure safety another five grains of quinine should be taken during the night.

For the same reason quinine taken in the morning or in the early part of the day is useless as a preventive.

The rule therefore should be to take five grains of quinine every evening at sunset and sleep under a good mosquito net; but where no mosquito net is available, then the dose of quinine must be repeated about midnight.

There are times, however, when the application of the above rule may prove insufficient to prevent a malarial infection, as when there has been exposure to a heavy mass infection in a highly malarious district, and where the person exposed has been unable to protect himself and has been badly stung by infected anopheles; in such cases the dose of quinine in order to be effective must be doubled, and ten grains taken at sunset and another ten grains during the night where no mosquito net is used.

Quinine for the prevention of relapses after an attack of malaria must be administered systematically and with extreme thoroughness.

Relapses are for the most part due to insufficiently prolonged treatment of the primary attack. It is a common practice to take massive doses of quinine when the temperature is high and the attack is on, and to discard it altogether till the next relapse appears; and it is inadequate treatment of this nature which frequently culminates in an attack of blackwater fever.

The following course is suggested as a general guide for the treatment of an attack of malaria, whether a primary attack or a relapse, and subsequent after treatment in order to minimise the risk of further relapses:—

- (a) Thirty grains of quinine a day (in doses of ten grains three times a day) till the highest daily rise of temperature does not exceed 100 degrees. This is generally for not longer than two to three days in the case of the *æstivo-autumnal* malaria, the common type of malaria in this country.
- (b) Then twenty grains a day (in four doses of five grains each) for three days.
- (c) Then fifteen grains a day (in three doses of five grains each) for seven days.
- (d) Then ten grains every evening at sunset for sixty days.
- (e) Then five grains every evening at sunset during the fever season, or whilst resident in a malarial centre.

During this period the diet should be a generous once, and only light work undertaken. Fatigue, exposure to the heat of the sun or sudden chills should be avoided. Moreover, a mosquito net should be rigorously used at night, not only as a protection from further infections, but also for the safety of the other members of the household, who might, through the agency of mosquitoes, also become infected from the patient.

It must be clearly understood that general rules cannot be applied to special cases, and the above scale of dosage cannot with safety be applied to delicate and pregnant women, young children, the aged and persons suffering from chronic disease. In such cases quinine administration must follow the advice of a medical practitioner with knowledge of the particular circumstances of each case.

So far we have dealt with the use of quinine as a preventive of primary infections and its administration in actual attacks, with the after treatment advised to minimise the risk of relapses.

Experiments conducted amongst the troops operating in malarial centres during the war, and also at hospitals in England and elsewhere, have shown that a small percentage of cases tend to relapse when treatment is stopped, whatever that length of treatment may have been. At present there is no method known which will permanently cure *all* cases, even when the treatment has been kept up for two to three months, and the failure of treatment in one or two cases cannot be used as an argument against the use of quinine in every case.

Where repeated relapses occur in spite of a continuous course of quinine treatment, the best method to maintain freedom from these attacks has been found to be an interrupted course, namely, giving quinine in full doses (fifteen grains in one dose) on two consecutive days in one week and omitting for the next five days. In these cases, however, the patient must be removed to a non-malarious country where there is no risk of fresh infections.

In the case of children, the following may be taken as an approximate guide for the maximum for any one dose:—

|                                         |           |
|-----------------------------------------|-----------|
| For children under 1 year ... ..        | 1 grain.  |
| For children under 2 years ... ..       | 2 grains. |
| For children from 2 to 5 years ... ..   | 3 grains. |
| For children from 5 to 10 years ... ..  | 4 grains. |
| For children from 10 to 15 years ... .. | 5 grains. |

One dose as above may be given daily as a preventive at the time and in the manner already indicated.

In order to meet the demands of the settlers and bring a pure article within reach of everyone at a reasonable price, the Government imports quinine in tablet form of guaranteed purity and standard dose, which quinine is sold at all Post Offices and postal agencies throughout the country. The price at which this is sold is liable to slight fluctuations with the market, the present retail price being 4s. 9d. a bottle of 100 tablets.



## Factors Influencing the Production and Composition of Milk.

By T. HAMILTON, M.A., N.D.A., N.D.D., Dairy Expert.

Milk has the following average composition:—

|                             |                 |
|-----------------------------|-----------------|
| Water ... ..                | 87.10 per cent. |
| Fat ... ..                  | 3.90 „          |
| Casein and albumen ... ..   | 3.40 „          |
| Milk sugar ... ..           | 4.85 „          |
| Ash (mineral matter) ... .. | 0.75 „          |

All of these milk constituents are more or less variable in quantity, and some of them vary widely, but nevertheless the above figures give a fair idea as to the constituents of average milk.

**Water.**—Supposing that a cow gives three gallons of milk per day, it will require two-and-a-half gallons of water for milk production alone, while she probably requires as much again to enable her to perform the various functions of her body. An ample water supply is therefore essential on every dairy farm, and its purity should be guaranteed. The writer has seen over £2,000 worth of cheese which had to be destroyed because of the neglect of one farmer who omitted to provide a clean water supply. The only water supply in this case was a stagnant dam in which the water was badly polluted. The cheese made from the milk of the cows drinking at this dam in two or three weeks developed a most objectionable flavour, the origin of which could easily be traced to the polluted water.

**Fat.**—The fat contained in the milk is its most important constituent. It is a mixture of six or eight separate or distinct fats, some of which are volatile and some non-volatile. It is the volatile fats which give to butter its characteristic flavour and odour. These volatile fats are derived from the food of the cow, and this explains why butter made in the winter when green fodder is scarce lacks that distinct freshness of flavour and odour present when there is an abundance of green feed.

The chief volatile fat to be found in butter is “butyrin.” This fat unfortunately is liable on exposure under certain conditions to decompose and form butyric acid, which gives that most unpleasant and disagreeable smell and odour known as rancidity. Milk or milk fat readily absorbs other volatile acids contained in the food, and

thus a great deal of cream is relegated to the third grade standard because of the fact that the cows have eaten such pungent plants as wild garlic or Mexican marigold. The essential oils contained in these two plants, being volatile, permeate the tissues of the cows, and of course taint the milk. Other feeds, *e.g.*, silage and turnips, sometimes taint the milk, but if these be fed after the milking is completed, taints derived from these sources can usually be avoided. The proportions of the fatty acids found in butter are not constant, but vary according to the food, the season of the year and the degree of lactation of the cows.

Butter fat derived from the milk of newly-calved cows generally contains a high proportion of volatile fats. The butter made from such milk is generally soft, and because under Rhodesian conditions cows as a rule calve from October to January, butter made during those months will not keep well, and should therefore be disposed of as quickly as possible. On the other hand, butter made from April onwards should keep in a good condition because the fats of which it is composed are less volatile and harder.

It has frequently been observed that certain foods such as cotton seed cake have a hardening effect on the fat, whilst linseed cake has the reverse effect. As the cotton industry develops we look forward to the time when greater use will be made of cotton seed cake to supply a ration in the early spring to counteract the softening effects due to the feeding of large quantities of immature succulent grasses. In the meantime the feeding of a small quantity of maize meal at this period of the year is most advisable.

**Casein and Albumen.**—These compose the flesh-forming constituent of the milk when it is used as food. Casein is a white substance which is partly in a state of suspension, partly colloidal and partly in solution. It is an organic substance which under the conditions of warmth and moisture obtaining in milk is singularly adapted for food for bacteria or germs. The increase in the number of these organisms is amazing if milk is kept at ordinary temperatures, as the following figures show. In the case of milk produced under clean conditions in sterilised vessels, the following figures were obtained after a protracted series of experiments:—

Temperature, 60 degrees. No. of bacteria per c.c.: After 12 hours, 4,000; after 48 hours, 26,000,000.

Temperature, 70 degrees. No. of bacteria per c.c.: After 12 hours, 19,000; after 48 hours, 2,000,000,000.

When milk was produced under dirty conditions and kept in unsterilised vessels the numbers of bacteria per cubic centimetre of milk were enormously increased, as the following figures show:—

Temperature, 60 degrees. No. of bacteria per c.c.: After 12 hours, 3,300,000; after 48 hours, 296,000,000.

Temperature, 70 degrees. No. of bacteria per c.c.: After 12 hours, 6,600,000; after 48 hours, 2,000,000,000.

It will be noticed what an enormous difference there is in the number of bacteria when the milk is obtained under clean conditions

as distinct from dirty conditions, and what a difference there is when milk is retained at low temperatures as compared with the conditions which exist when milk is kept at a higher temperature. During the summer months it is almost impossible under natural conditions to get the temperature of milk and cream below 70 degrees. The necessity for scrupulous cleanliness is thus all the more imperative. On most farms in this country conditions as regards cleanliness of milk buckets, clean milkers and clean conditions for milking are altogether deplorable. As a rule the supply of boiling water for the sterilisation of separator parts, buckets, etc., is conspicuous by its absence. Very little attempt is made to cool the cream after separation and to keep it cool pending its despatch to the creamery. If farmers then would take to heart the lesson taught by the figures of the increase of bacteria quoted above they would soon realise why so much of the cream delivered to the creameries and so much of the butter made on the farm during the summer months are of second and third grade quality. Bacteria are microscopic organisms which pass through any filter, and no amount of straining through patent milk sieves will get rid of them if once they have gained admittance either through the agency of the milker's hands or from unsterilised vessels. When once they have gained admittance the only obvious thing to do is to keep the milk or cream at the lowest possible temperature, and so check their rapid rate of increase.

Casein is highly important in the manufacture of cheese and dried milk. Its food value is recognised as being of supreme importance because it is the basis of several patent foods and food tonics, which have an extensive sale. It is a well known fact that casein is coagulated by the action of rennet or weak acids. It has also a commercial value, and large quantities of dried casein were manufactured throughout the Union, especially during the war, for making a medium to carry the colouring matter in the manufacture of paint.

The proportion of albumen in normal milk is small. It is coagulated by heat, and mixed with cream forms the "skin" on the top of milk when it is boiled. When a cow is newly calved the first milk or colostrum is extremely rich in albumen, and this feature can be readily seen if colostrum or "beastings" is boiled. The albumen coagulates and sets into an almost solid mass. When cheese is made the albumen, being soluble, flows away with the whey, which thus contains water, milk sugar and a small quantity of albumen and fat. If whey is to be used as a feed it is obviously deficient in flesh-forming materials or protein; this deficiency must therefore be made good by the feeding of beans, peas, ground nut cake or other feeds rich in this particular flesh-forming product.

**Milk Sugar.**—This is perhaps the most stable of all the constituents of milk. It is less sweet than cane or beet sugar, but has the same chemical composition. As a food it gives energy and heat, and as such is a most important feature of milk used as a food. Milk sugar is quickly acted upon by lactic ferments, and under normal conditions of temperature quickly breaks down into lactic acid. It is interesting to learn that it was the every-day phenomenon of milk

turning sour which led Pasteur, the great French scientist, to investigate the cause of this change and to the first discoveries in the great science of bacteriology. Milk sugar, being soluble, remains in the whey when the casein is removed in cheese-making, and by chemical methods can be easily recovered. Milk sugar is usually sold by the chemist as a soft white powder resembling confectionery sugar, and is much used in the manufacture of drugs.

**Ash or Mineral Matter.**—The ash is a small but highly important constituent of milk. It is composed largely of phosphates of lime, potash, iron and magnesia, as well as the chlorides of potash and soda. The soil of this country is generally deficient in lime and phosphate and it will be realised that if the cow is not to draw on her own body tissue in order to supply these essential materials in the milk, this deficiency must be made up by the feeding of mineral matter, the chief of which are salt and sterilised bone meal. A mixture composed of these materials should be regularly supplied. In course of time animals to which bone-forming materials are denied must necessarily degenerate and lose that bulkiness of frame which is so necessary a feature in dairy stock.

**Vitamins.**—These are obscure substances present in all foods, and certainly present in milk. Although an article has recently appeared in this journal regarding these, a brief summary may be of service. There are several kinds of vitamins necessary for normal health and growth, and when they are omitted from foods, "deficiency diseases" develop. These vitamins are known as A, B and C respectively. *Vitamin A* is found in certain foods and especially in milk. It seems to be associated with butter fat and with food-stuffs which are coloured yellow, such as the yolk of an egg. This colouring matter seems to be derived from the green matter or chlorophyll contained in plants. The amount of vitamin A required for growth is extraordinarily small. In an experiment conducted by the Wisconsin University to find out the relative merits of white and yellow maize, it was proved that rats would not thrive on a ration of white maize and thick skim milk, whereas they put on weight and thrived exceedingly well on yellow maize and thick separated milk. When, however, an almost infinitesimal portion of butter was added to the white maize ration, the rats immediately improved in condition.

To quote from an article on this subject in the *Union Agricultural Journal*: "It has been shown that a rat, if on an adequate diet, excepting for the vitamin fat-soluble A, will keep good health and grow normally when 0.2 gram to 0.4 gram of butter is given daily to supply the missing vitamin."

Remarkable experiments with fowls fed on white maize, separated milk and mineral matter, and with others fed on yellow maize, separated milk and a similar mineral ration, are detailed in the same article. The writer sums up the results of these experiments as follows:—

"The result after the two maizes were interchanged, and again after green lucerne had been added to the ration, corroborates the Wisconsin results obtained with rats, and shows that as long as white

maize is supplemented with some source of the vitamin fat-soluble A it is as good a food as yellow maize."

It is therefore obvious that our dairy cows, when being fed on maize during the winter, require above all else green stuff, pumpkins or other succulent feeds containing vitamin A in abundance, otherwise they will fall off in condition and become unprofitable as milk producers.

*Vitamin B* is not so abundant in milk as vitamin A. It is found especially in fresh foods such as unpolished rice, Boer meal and other foods which are not too highly refined.

*Vitamin C*, often called the anti-scorbutic vitamin, is easily destroyed by heat. If milk is to be pasteurised or boiled, as is advisable in this country, the destroyed vitamin can be easily replaced by the addition of a small quantity of lemon or tomato juice. Vitamins A and B are not affected by cooking to any appreciable extent.

**Factors affecting the Butter Fat Content.**—The butter fat percentage in milk varies greatly. This variation is attributed to various causes.

(1) *Unequal Periods of Milking.*—In the great majority of cases the writer has observed that the morning's milk is poorer in fat than is the milk obtained at the afternoon or evening milking. This is generally attributed to the fact that in most cases the period which elapses between afternoon and morning milking is generally shorter by three to four hours than that elapsing between morning and afternoon milking. This is probably due to the fact that in most cases a portion of the fat is re-absorbed by the lymphatics when the milk remains a long period in the udder.

It is not, however, a universal rule that the milk is richer after remaining for the shorter period in the udder. The writer has sometimes observed that in Rhodesia the morning's milk is richer than that obtained at the afternoon milking, and that in certain herds this is almost the invariable rule. This is especially the case where animals are kraaled at night without feed being given.

(2) *The Period of Lactation.*—Provided that the cow is in fair physical condition at time of calving, the fat percentage is fairly high during the first month and then drops in the second. After that the improvement is gradual, until about the eighth or ninth month the fat percentage is at its maximum.

The following is the average obtained over 139 lactations of Friesland cattle:—

| Month of Lactation. | Fat Percentage. |
|---------------------|-----------------|
| 1st                 | 3.565           |
| 2nd                 | 3.324           |
| 3rd                 | 3.310           |
| 4th                 | 3.340           |
| 5th                 | 3.385           |
| 6th                 | 3.435           |
| 7th                 | 3.481           |
| 8th                 | 3.545           |
| 9th                 | 3.599           |
| 10th                | 3.604           |

(3) *The Influence of Weather.*—The writer has frequently observed when testing for butter fat in the low country of the Union, *e.g.*, on the Natal coastal belt, that during the summer the fat percentage is abnormally low. This fact is confirmed by a recent article in *Hoard's Dairyman*, wherein it is graphically shown that in a great number of cases the milk produced during the summer months shows a decided tendency to drop in fat content. Another interesting fact has been shown by the investigation, and that is that the cows calving in the autumn produce a larger quantity of milk with a higher percentage of butter fat than that obtained in either spring, summer or winter. The averages of 11,130 individual cows give this interesting result:—

|               | Lbs. Butter fat. | Lbs. Milk. |
|---------------|------------------|------------|
| Spring ... .. | 236              | 5,775      |
| Summer ... .. | 234              | 5,863      |
| Autumn ... .. | 267              | 6,591      |
| Winter ... .. | 254              | 6,338      |

Many experienced cattle men in this country and in the Union prefer to have their cows calving in April, May and June. Most state their reason for this is that the calves born during these cool months thrive better than those born in the spring, but in the light of the American investigation there may be something in the fact that the cows' milk is both more plentiful and richer during these months; and this, together with the fact that weather conditions are more healthy during these months, accounts for the increased thriftiness of the calves.

As regards excessive cold and wet weather, especially if the cows are wet as well as cold, it is a commonly observed fact that the milk suffers both as regards quantity and quality. The writer well remembers a case of a cow entered for the milking competition at Estcourt Show in the month of June. The attendant washed the cow early on a cold, frosty morning. The consequence was that the cow did not give at the test 1 per cent. of butter fat in her milk. On the second day of the show under normal conditions she gave well over 4 per cent. Dairy men would therefore be well advised during the winter months to heat up a portion of their dip in order to raise the temperature of the solution to above 60 degrees. If this is not done, milk production must suffer.

(4) *The Influence of Food.*—If the cow is properly fed with a balanced ration it has been proved that only temporary derangements in the fat content can take place. On the other hand, if the ration is not properly balanced, or if excessive quantities of succulent feed such as majordas, immature maize or immature green grass be fed, the fat percentage can be perceptibly lowered. In a case which came under the writer's notice, cows fed with 120 lbs. of mangolds per head per day were almost entirely under the butter fat standard. When the ration was adjusted, not a single cow gave milk under the 3 per cent. standard. The same phenomenon has been observed in America, where exhaustive experiments with prickly pear fed to dairy cows proved that when the quantity of prickly pear was increased the fat content

was lowered. This feature is also confirmed by the writer's experience in cheese-making in Rhodesia. In the spring after the first rains the return of cheese per gallon of milk is extraordinarily low, because the milk tests only 3 per cent. on the average, *i.e.*, when cows are milked in the ordinary way and the calves get the strippings. At this time, if we are to get the best out of our cows, an extra ration of 2 or 3 lbs. of maize meal is most advisable.

(5) *The Influence of Milking.*—It is a well known fact that a good milker will get more milk from a cow than a poor milker. The efficiency of the milker also has a most marked effect upon the butter fat content. In some experiments carried out at the Harper Adams School of Agriculture the results of a good milker as against a poor milker were most marked, the efficient milker obtaining milk which was almost 1 per cent. higher in butter fat than the poor milker.

It is also well known that the variation in the percentage of fat in the milk first and last drawn is very great. The first milk drawn is much the poorer in fat, being only sometimes 1 per cent., whilst the strippings often contain anything from 8 to 10 per cent. of butter fat. So long as the almost universal system prevails of allowing the calf to take the strippings, so long will dairying in this country remain in an unsatisfactory condition. The practice of hand-rearing calves is gradually becoming more widely adopted, but a long time must elapse before it becomes at all general. Until that time, the wasteful practice of rearing unremunerative bull calves must continue.

(6) *The Physical Condition of the Cow at Calving.*—It has been observed, since milk testing became more general, that the physical condition and degree of fatness of the cow at the time of parturition has a most marked effect upon the fat content of the milk. Cows in poor physical condition at time of calving almost invariably give milk of poor quality, and frequently give trouble in "cleansing" or getting rid of the after-birth. This latter feature is generally attributed to lack of condition following on lack of green stuff, and is frequently observed in October and November or even later. The milk produced under such conditions is often below the legal standard.

As regards both fat and solids-not-fat, the writer has lately had the opportunity of testing mixed milk from dairy herds in Matabeleland, and has found almost without exception that cows whose physical condition has not been maintained by a ration of green stuff or ensilage throughout the dry season give milk of exceptionally poor quality. Even if fed on ensilage and concentrates whilst in milk, they do not respond if, previous to calving, this succulent matter has been denied them. The best milk analysed during this series of tests was produced by cows which had ample green stuff from irrigated lands, whilst the poorest came from cows which were fed on dry hay only. Those cows to which ensilage was fed throughout the dry season produced milk which was satisfactory in every respect. The lesson which the results of these tests teach is that farmers who neglect to provide sufficient silage to tide them over to the end of November do not obtain the best results from their cows; and if they are selling milk they

run a serious risk of being prosecuted for offering for sale a commodity the fat content of which may well be below the legal standard.

(7) *Common Causes of Variation.*—It has been frequently noted that change of environment, as, for instance, cows entered for milking competitions at shows, has a marked effect on the fat percentage. It is therefore suggested that owners of cows which are entered for milking competitions at our various shows should send their cows to the shows a few days prior to the actual competition. A feverish condition also predisposes a cow to variation in the fat percentage of her milk. A case of a cow at a milking competition suffering from a mild attack of gall-sickness has been seen by the writer. This cow at her milking gave the abnormal test of 8 per cent. butter fat, but on the following day she fell back to much below her normal percentage, and her milk production was also greatly lessened.

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## Paw Paw Jam.

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To every pound of fruit allow  $\frac{1}{2}$  lb. sugar. Whole ginger according to taste, or lemon juice if preferred.

Peel fruit, remove seeds and cut into small squares. Wipe preserving pan with a little paper dipped in sweet oil.

Put fruit, sugar, ginger or lemon in; let all stand for a little while, then boil quickly. Remove from stove when the fruit is clear and soft, and put into jars.



## Measles in Swine.

By P. D. HUSTON, M.R.C.V.S.

This is probably the commonest and most widespread disease of swine in Southern Rhodesia. The condition, which in appearance looks like a number of small pearl-shaped bladders no longer than a small pea, embedded in the muscle fibres and occasionally surrounded by a watery fluid, is due to the presence in the muscles of the *Cysticercus cellulose*, which is the bladder worm stage of the *Taenia solium*, the commonest tapeworm of man. The term bladder worm arises from the shape of the cyst and the fact that it contains fluid.

The muscles most commonly invaded are those of the tongue, neck, fillet, shoulder and thighs. During life it is said that infected animals can be detected by the presence of the cysts in the muscles of the tongue. To do this the tongue has to be drawn forward out of the mouth and the under surface of it examined, when the cysts will look like small pearls under the surface. It will be found that this method is only very seldom successful, because although the tongue is commonly, it is not always, infected, and even if it is infected, it may not be possible to see the cysts. *Post mortem* examination is the only means by which it can be determined that an animal is not suffering from measles. The cysts, if not liberated during their life, may degenerate, and on *post mortem* examination will appear as greyish coloured bodies embedded in the muscle, which, if cut into, are either caseous or calcareous according to the age of the lesion.

There is no curative treatment for the disease, but an account of the life history of the tapeworm will give a direct indication of the preventive treatment necessary to reduce the infection to a minimum.

The eggs are found in the excreta of man, and when the excreta are eaten by the pig the gastric juices dissolve the outer coat of the ovum and liberate the embryo. The embryo on passing through the bowel wall is taken up by the blood stream and carried to its destination, where it becomes encysted; development then commences, and it takes about three months for a cyst to reach maturity. The muscle so infected has now to be eaten by man in a raw or partially cooked condition, so that the vitality of the mature cyst is not affected; the cyst on reaching the stomach is dissolved by the digestive juices, and the scolex or head of the tapeworm is liberated. In the *Cysticercus cellulose* there is only one scolex in each cyst, so only one tapeworm can develop. The scolex becomes attached by hooks to the stomach wall, and growth

commences by the formation of segments behind it, the oldest segments being furthest away. In four to five months the segments become mature and are cast off, to be passed out in the faeces of man to infect further animals. Each worm can produce eight to nine hundred segments, and each mature segment may contain up to ten thousand eggs.

From this life history it will be seen that only three conditions are necessary to reduce the extent of the infection.

- No. 1. Proper sanitary arrangements for human beings.
- No. 2. Meat inspection and destruction of all infected carcasses.
- No. 3. Control of the feeding of pigs.

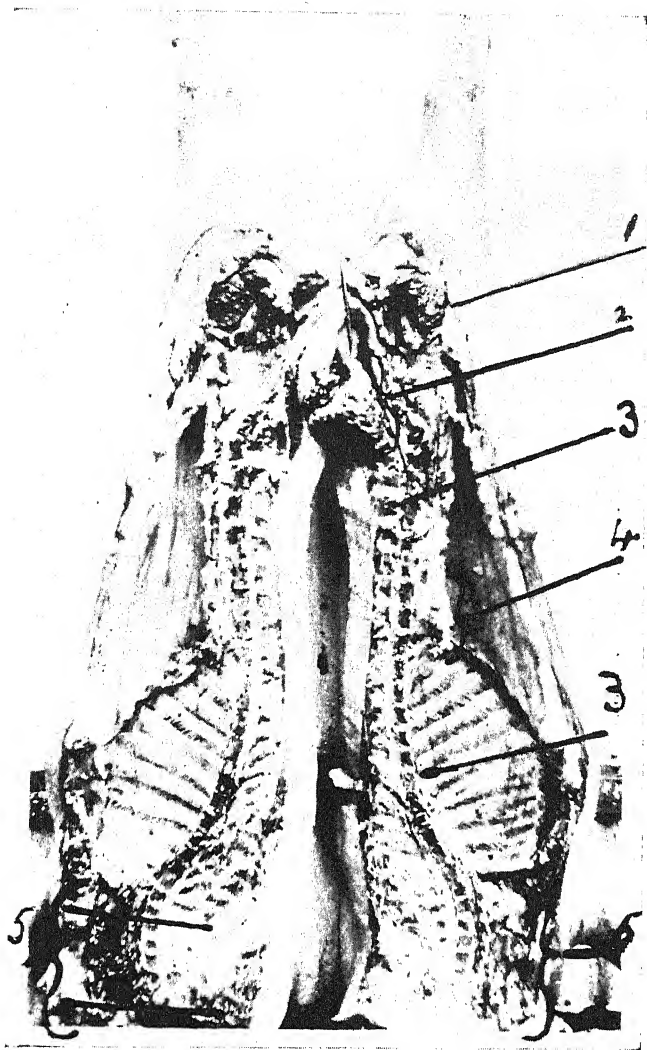
This control can only be successfully carried out if pigs are kept in sties and small paddocks, and under no circumstances are allowed to graze on the veld; also if care is taken to see that it is impossible for the food and water to be contaminated by sewerage.

The plate accompanying this article was taken from a photograph of a pig killed at one of the Salisbury bacon factories. The animal was cut in half, exposing the inner sides of the thighs, abdomen and chest, and also a division of the muscles of the neck; the heart will be seen suspended by a hook from one of the thighs. On examining the photograph closely it will be seen that numerous small white spots appear—

- (1) on the cut surfaces of the muscles of the thighs;
- (2) on the heart;
- (3) on the muscles between the vertebræ of the back;
- (4) on the fillet;
- (5) on the cut surface of the muscles of the neck.

These are all cysts of the *Tenia solium*. This carcass was the most extensively infected one that I have ever seen.

It is a remarkable fact that during life the presence of these cysts seems to cause the animal little or no inconvenience; the pig thrives and fattens as well as any other in the sty, and in support of this I may mention that on two occasions after I had inspected and condemned carcasses for measles I was informed that these carcasses had both taken prizes in their respective classes at shows a week before as prime bacon pigs.



Carcase of a pig badly infected with measles and killed at a  
Salisbury bacon factory.



## Bacterial Infection of Tobacco Seed Beds.

By F. EYLES, Mycologist.

The bacterial leaf spots found on the tobacco crop in Rhodesia have not yet been specifically studied under local conditions. It is probable that both wildfire and blackfire (angular) occur, but that the Rhodesian forms are precisely identical with those of the Union and America remains to be proved. Assuming, however, that wildfire and blackfire as found in Rhodesia are specifically the same as these two diseases in other countries, it is still possible that the Rhodesian climatic and soil conditions may have had some modifying effect on the life cycle of the parasites, resulting in certain differences in external symptoms.

In America the presence of bacterial infection in the seed bed can usually be detected by fairly obvious symptoms, such as distortion or discoloration of otherwise healthy-looking leaves, and the existence of small but characteristic spots also on otherwise green and healthy-looking leaves. The simulation of fungoid damping-off is another well-known symptom.

Several tobacco planters, who last season lost heavily from bacterial spots, have told me that no sign of disease was observable in the seed beds, and it was not until the crop reached the stage for "topping" that the infection was discovered; but from that stage on the attack developed rapidly, and the injury done was very serious. In these circumstances one is bound to suspect that the disease had been overlooked in the seed bed, because (1) the rapid spread of the disease after observation indicates that it had probably been incubating in the plant for some time and did not originate in the field; (2) though infection may take place in the field, it is probable in such case the diseased plants would occur at irregular intervals, or at spots of infection, instead of being general throughout the field; and (3) the infection of the crop took place in fields where no tobacco had been planted before, and therefore the chances that the disease was introduced from the seed bed preponderate.

On the 14th November I had the opportunity of inspecting certain tobacco seed beds near Salisbury in company with Mr. D. D. Brown, Assistant Tobacco Expert. We examined a number of beds and thousands of seedlings, but we found altogether only about half a dozen leaf spots showing doubtful symptoms of wildfire. It was noticeable,

however, that in some of the seed beds there were small areas where the plants had "damped-off." The few leaves having suspicious spots and some of the dead and dying seedlings from the damped-off areas were brought in for examination in the laboratory. A preliminary examination showed the presence of bacteria in some of the leaf spots and also in the seedlings from the damping-off areas. It is too early yet to say what specific organisms are the cause of the symptoms found, as this investigation will take time.

I am writing now as a matter of urgency to draw the attention of all tobacco growers in Rhodesia to the fact that it is almost certain that the attacks of wildfire and blackfire originate in the seed bed. The only hopeful measures of control must also be taken in the seed bed. The absence of obvious leaf spots in the seed beds is no proof that bacterial infection is absent. The presence of damping-off areas should meanwhile be taken as presumptive proof of the presence of infection. All seed beds should be searched for damping-off, and every area of damping-off should be treated as positively diseased, that is to say all dead and dying seedlings, together with a 12-inch margin of healthy-looking plants all round the area, must be carefully dug out and burnt, the surface soil of the same area removed and burnt. If preferred these areas, that is the entire damped-off place and 12 inches margin round it, may be sprayed with formalin of the strength 1 formalin to 15 water.

It should be noted that the diseased plants that had damped-off were found to be densely infested with bacteria, and until proof to the contrary is forthcoming we must assume these bacteria to be either wildfire, blackfire or some other dangerous disease.

The weekly protective spraying of tobacco seed beds with Bordeaux mixture, strength 4:4:50, should be continued.

# Annual Report of Experiments, 1922-23.

AGRICULTURAL EXPERIMENT STATION, SALISBURY.

By J. A. T. WALTERS, B.A., Agriculturist.

As regards rainfall, the 1922-23 season constituted a record for the Experiment Station, Salisbury, the precipitation, which amounted to no less than 42.69 ins. in 105 days, being the heaviest in the history of the station. The previous season, 1921-22, had established a record for dryness, the total precipitation not exceeding 16.82 ins., distributed over 44 days of rainfall. From the experimental point of view such extreme variations are useful and desirable, as they afford data for the study of the influence of precipitation upon the large variety of crops under observation at the station. Fortunately these extreme cases were preceded in 1920-21 by an almost ideal season, during which 33.4 ins. of rain were recorded, and which was fairly evenly distributed during the whole of the growing season. The 1922-23 rainfall may be analysed as follows:—

|       |                  | Total number<br>of days on<br>which rain<br>fell. | Number of<br>days on which<br>.25 in. or more<br>fell. | Total rainfall<br>for month.<br>Ins. |
|-------|------------------|---------------------------------------------------|--------------------------------------------------------|--------------------------------------|
| 1922. | September ... .. | 1                                                 | ...                                                    | .07                                  |
|       | October ... ..   | 9                                                 | 2                                                      | 1.23                                 |
|       | November ... ..  | 15                                                | 5                                                      | 4.98                                 |
|       | December ... ..  | 14                                                | 11                                                     | 5.58                                 |
| 1923. | January ... ..   | 20                                                | 9                                                      | 7.36                                 |
|       | February ... ..  | 18                                                | 12                                                     | 9.66                                 |
|       | March ... ..     | 23                                                | 13                                                     | 11.97                                |
|       | April ... ..     | 2                                                 | 1                                                      | .51                                  |
|       | May ... ..       | 3                                                 | 2                                                      | 1.33                                 |
|       |                  | <hr/> 105                                         | <hr/> 55                                               | <hr/> 42.69                          |

It is thus possible to give the average returns for the principal crops grown on the station during three very different seasons. Since in each case the number of experimental trials were great, these figures

afford a useful indication of the effect of scanty and excessive rainfall upon the yield of each particular crop.

| Crop.                      | 1920-21.                               | 1921-22.                               | 1922-23.                              |
|----------------------------|----------------------------------------|----------------------------------------|---------------------------------------|
|                            | Rainfall<br>33.4 ins.                  | Rainfall<br>16.8 ins.                  | Rainfall 42.69 ins.                   |
| Maize ... ..               | 23.8 bags<br>(average of<br>23 trials) | 10.3 bags<br>(average of<br>45 trials) | 14.75 bags<br>(average of 34 trials)  |
| Ground nuts ... ..         | 1,406 lbs.                             | 1,336 lbs.                             | 754 lbs.<br>(average of 17 trials)    |
| Velvet bean seed ... ..    | 1,120 lbs.                             | 903 lbs.                               | 804 lbs.                              |
| Buckwheat ... ..           | 620 lbs.                               | 420 lbs.                               | 1,388 lbs.<br>(average of 5 trials)   |
| Linseed ... ..             | 396 lbs.                               | ...                                    | 210 lbs.<br>(average of 9 trials)     |
| Sunflower seed ... ..      | 1,752 lbs.                             | 728 lbs.                               | 1,100 lbs.                            |
| Sweet potato tubers ... .. | 15,290 lbs.                            | 10,000 lbs.                            | 13,330 lbs.                           |
| Sweet potato vines ... ..  | 10,224 lbs.                            | 6,240 lbs.                             | 15,170 lbs.<br>(average of 20 trials) |
| Sudan hay ... ..           | 2,469 lbs.                             | 3,670 lbs.                             | 1,305 lbs.                            |
| Sudan, teff, oats and peas | 2,736 lbs.                             | 2,169 lbs.                             | 2,970 lbs.                            |
| Tepary bean ... ..         | ...                                    | 840 lbs.                               | 428 lbs.                              |

From the above table it will be observed that, taking the almost ideal season of 1920-21 as a basis, most crops suffered in the two following years seriously, both through deficiency and excess of rainfall. Ground nuts withstood drought well, and Sudan hay was particularly free of disease under dry conditions which enabled as many as three cuttings to be taken, while Tepary bean in the dry season of 1921-22 gave the heaviest recorded return. Heavy rainfall on the other hand seemed to have suited buckwheat and increased the yield of sweet potato vines and of mixed hays, and dolichos beans stood the wet conditions admirably, in marked contrast to the velvet beans. The returns for maize during these three seasons are particularly significant, and show very definitely to what a large extent this crop is dependent upon weather conditions.

### EXPERIMENTS WITH MAIZE.

The premier position of the maize industry in this country entitles this crop to a foremost place in the experimental work undertaken at the station. The problems connected with it bear mainly upon the possibility of increasing the acre yields of grain, combined with the permanent maintenance of soil fertility. This latter condition involves aiming not only at a high seasonal yield (such as may be obtained







*Andropogon gayanus*, one of the earliest of our native grasses, showing growth after eight months' drought. Salisbury Experiment Station, November, 1923.



Kudzu vine, showing growth after eight months' drought. Salisbury Experiment Station, November, 1923.



by the application of fertilisers alone), but at a satisfactory yield over a series of years. In this connection the rotational trials started ten years ago afford definite data of great value on the results obtained with certain type methods of treatment. As these trials are reported upon annually, the trend of the conclusions arrived at has been evident for some time, but the results now published show still more decisively how important a part proper cultural methods play in the continuous production of high yields. Thus the results obtained in the old rotational trials (now in their tenth year) might be presented as follows: Assuming that four areas of 100 acres each were placed under different methods of cultivation for the ten years 1913 to 1923, A being put to maize continuously, B one-half to maize and one-half left to bare fallow yearly, C one-third only to maize, two-thirds to hay and leguminous crops, D one-fourth to maize, three-fourths to hay, leguminous and root crops—the roots only receiving six tons dung each year—the result of the ten years' operations as revealed in the harvested crops obtained in these experiments would be as follows:—

|   | Acreage under<br>maize, 1913-23. | Total number of<br>bags harvested. | Per cent. |
|---|----------------------------------|------------------------------------|-----------|
| A | 1,000                            | 5,775                              | 100       |
| B | 500                              | 5,295                              | 91        |
| C | 333 $\frac{1}{3}$                | 4,921                              | 85        |
| D | 250                              | 4,532                              | 78        |

In other words, over ten years B would have harvested almost as much maize on half the land as A had done on the whole; while C and D would have harvested 85 per cent. and 78 per cent. respectively on only one-third and one-fourth of the land utilised for maize by A. C and D would in addition have the yields of the other crops grown in rotation with the maize. The table of results given below further shows how the permanent fertility of the continuous plots has been impaired, and how the yields have fallen below the limit of profit.

OLD ROTATION EXPERIMENTS, SERIES A,  
COMMENCED 1913-14.

|                                                 | Yield<br>per acre,<br>1922-23. | Yield<br>per acre,<br>1921-22. | Average yield<br>per acre. |
|-------------------------------------------------|--------------------------------|--------------------------------|----------------------------|
| <i>System of cropping.</i>                      |                                |                                |                            |
| 1. Maize continuous without manure, 10th season | 2.4 bags                       | 3.75 bags                      | 6.15 bags (9 years)        |
| 2. Maize alternating with bare summer fallow    | 5.1 bags                       | 13.25 bags                     | 11.2 bags (9 years)        |
| <i>Three-course rotation.</i>                   |                                |                                |                            |
| 3. Maize ... ..                                 | 15.5 bags                      | 12.75 bags                     | 14.8 bags (8 years)        |
| 4. Wheat ... ..                                 | 65 lbs.                        | 190 lbs.                       | ...                        |
| 5. Velvet beans ... ..                          | 970 lbs.                       | 5 bags seed                    | ...                        |
| <i>Four-course rotation.</i>                    |                                |                                |                            |
| 6. Maize ... ..                                 | 18.9 bags                      | 11.25 bags                     | 18.1 bags (7 years)        |
| 7. Velvet beans ... ..                          | 750 lbs.                       | ...                            | ...                        |
| 8. Mangels (receive 6 tons dung)                | 11.8 tons                      | 13.25 tons                     | ...                        |
| 9. Wheat ... ..                                 | 210 lbs.                       | 110 lbs.                       | ...                        |

NEW ROTATION EXPERIMENTS, COMMENCED 1919-20.

These were devised to discover how far the results obtained in the old rotational trials could be applied practically in Rhodesia. They resolve themselves into trials to ascertain to what extent maize can be grown continuously, provided certain measures are taken to prevent the depletion of soil fertility. The courses adopted in the rotational trials described above failed in their appeal to the Rhodesian farmer owing to the difficulty of disposing commercially of any other crop than maize. It was therefore decided to ascertain the effect of growing maize for three seasons in succession, followed by a change crop every fourth year, and restoring part of the fertility depleted by application of dung at the rate of eight tons per acre or complete artificials at the rate of 150 lbs. per acre once every four years. It will be observed that where dung is applied the change crop adopted is a straw crop such as Sudan grass, while where artificials are applied a crop of velvet beans is ploughed in. The trials are not yet sufficiently advanced to enable any definite deductions to be made, but it is worthy of note that the yields recorded are obtained from soil similar to that employed for the old rotation trials, alongside of which they lie.

The beneficial effect of green manuring and artificial fertiliser in

plots 7 to 10 is very remarkable. In 1919-20 the yields in plots 2 to 5 (straw crop and dung) were heaviest. The balance has by now turned in favour of the other treatment.

|                                                                                                                                                                   | Yield<br>per acre,<br>1922-23. | Yield<br>per acre,<br>1921-22. | Yield<br>per acre,<br>1920-21. | Yield<br>per acre,<br>1919-20. |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|
| <i>System of cropping.</i>                                                                                                                                        | Bags.                          | Bags.                          | Bags.                          | Bags.                          |
| 1. Maize continuous ... ..                                                                                                                                        | 10.4                           | 13.0                           | 27.2                           | 25.5                           |
| <i>Four-course rotation.</i><br>Maize three years, receiving one dressing of dung, and one crop of Sudan grass every fourth year.                                 |                                |                                |                                |                                |
| 2. Maize (dung in 1919-20) ...                                                                                                                                    | 12.6                           | Sudan<br>grass<br>14.25        | 28.0                           | 26.0                           |
| 3. Sudan (maize dunged 1920-21) ...                                                                                                                               | Sudan<br>grass<br>18.6         | 15.7                           | 26.9                           | 23.7                           |
| 4. Maize (dung in 1921-22) ...                                                                                                                                    | 17.3                           | 13.7                           | 28.5                           | Sudan<br>grass<br>24.6         |
| 5. Maize (dung in 1922-23) ...                                                                                                                                    | 13.1                           | 11.75                          | Sudan<br>grass<br>24.2         | 23.3                           |
| <i>Four-course rotation.</i><br>Maize three years, receiving one dressing of 150 lbs. complete fertiliser, one velvet bean crop ploughed under every fourth year. |                                |                                |                                |                                |
| 7. Maize (fertilised 1919-20) ...                                                                                                                                 | 18.8                           | Green<br>manure<br>11.7        | 25.9                           | 23.1                           |
| 8. Velvet beans (maize fertilised 1920-21)                                                                                                                        | Green<br>manure<br>17.4        | 12.7                           | 24.6                           | 23.0                           |
| 9. Maize (fertilised 1921-22) ...                                                                                                                                 | 21.1                           | 14.5                           | 28.7                           | Green<br>manure<br>19.2        |
| 10. Maize (fertilised 1922-23) ...                                                                                                                                |                                |                                | Green<br>manure                |                                |

**Maize and Sunflower Rotation.**—This experiment is now in its fourth season, and the results show that sunflower can be regarded as a useful change crop for maize. It is to be noted that this land has never received manure.

|                                  | 1922-23.<br>Bags. | 1921-22.<br>Bags. | 1920-21.<br>Bags. |
|----------------------------------|-------------------|-------------------|-------------------|
| Maize after maize ... ..         | 11.9              | 8.75              | 23.0              |
| Maize alternating with sunflower | 15.3              | 10.75             | 22.25             |

**Maize after Other Crops.**—These trials, planned to note the effect of various crops upon the succeeding maize crop, have failed so far to give more than general indications. Thus in the dry season of 1921-22 ploughing in the *whole crop* of Sunn hemp, ground nuts, velvet beans and Niger oil gave improved yields in each case over

ploughing in the *stubble only*. In the very wet season of 1922-23, however, this result was reversed in each case. More uniform results have been obtained for the effect of using a legume as against a non-legume on a succeeding crop of maize, as the following table will show. The non-legumes used were Niger oil, oats, hibiscus, cotton, teff and buckwheat.

|                                | 1922-23. | 1921-22. | 1920-21. |
|--------------------------------|----------|----------|----------|
|                                | Bags.    | Bags.    | Bags.    |
| Maize after legumes ... ..     | 13.5     | 10.3     | 23.75    |
| Maize after non-legumes ... .. | 11.3     | 8.7      | 20.8     |

As a further test of the effect of green manure on maize, two immature crops of velvet beans were ploughed under to compare with the usual practice of ploughing in one mature crop, with the following result:—

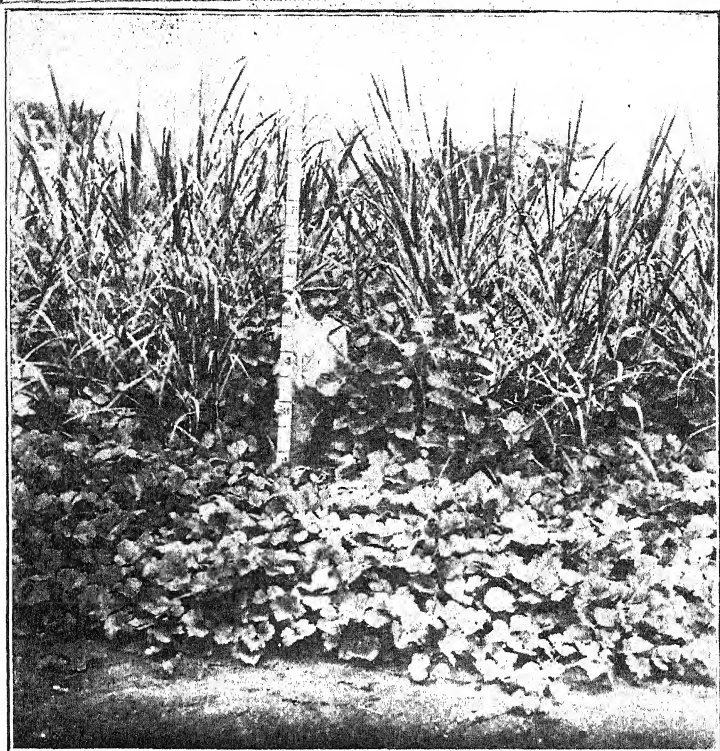
|                                                                           | Yield of maize<br>in 1922-23.<br>Bags. |
|---------------------------------------------------------------------------|----------------------------------------|
| 1. Velvet beans sown December, 1921, ploughed in April, 1922              | 19.2                                   |
| 2. Velvet beans sown December, 1921, ploughed in February,<br>1922 ... .. | } 17.7                                 |
| Sown again February, 1922, ploughed in May, 1922 ...                      |                                        |

**Perfect v. Reduced Stands of Maize.**—This important experiment has been devised to establish the significance of the full stand of plants in securing a high yield of grain per acre. It would normally be expected that reduced stands would naturally involve reduced yields. But such is not always the case. In the very dry season of 1921-22 the 90 per cent. stand gave a heavier yield of grain than the full stand, due possibly to the fact that the reduced number of plants had a greater share of the moisture available. In this last season of ample rainfall the former and expected results were re-affirmed, as the attached table will show:—

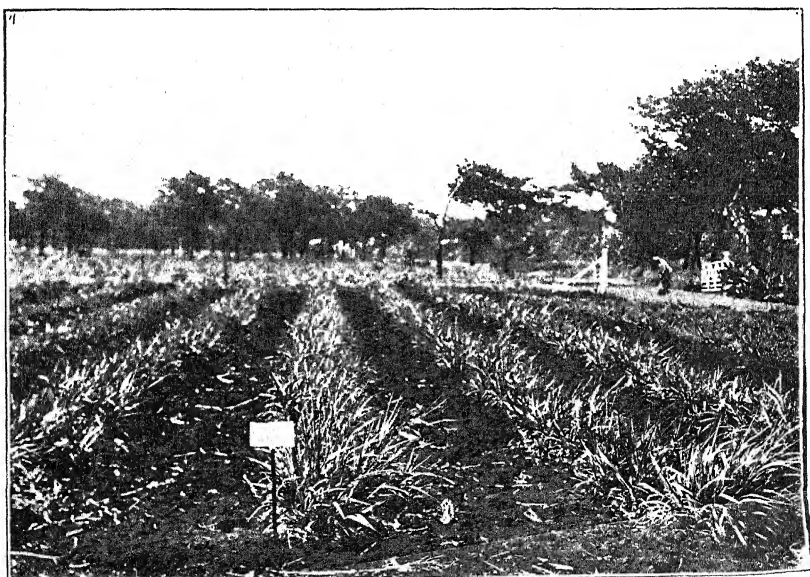
|                                                  | Yield in bags<br>per acre. |
|--------------------------------------------------|----------------------------|
| Perfect stand (average of two plots) ... ..      | 15.1                       |
| 90 per cent. stand (average of two plots) ... .. | 12.8                       |
| 75 per cent. stand (average of two plots) ... .. | 10.7                       |
| 60 per cent. stand (average of two plots) ... .. | 8.6                        |

These results are extremely significant, as pointing out a line of action by which marked improvements in yields may be obtained. It has been estimated that Rhodesian stands of maize on an average do not exceed 60 per cent. of a full stand. It is therefore clear that attention needs to be directed to what can only be regarded as a serious source of loss to the Rhodesian farmer.

**Date of Planting Trials.**—The results this season confirm those reported in previous seasons, viz., that mid-November to mid-December is the best time for planting in a normal season on our high veld. It would seem that if for any reason planting is considerably delayed beyond the latter date, reduced yields of grain may be expected.



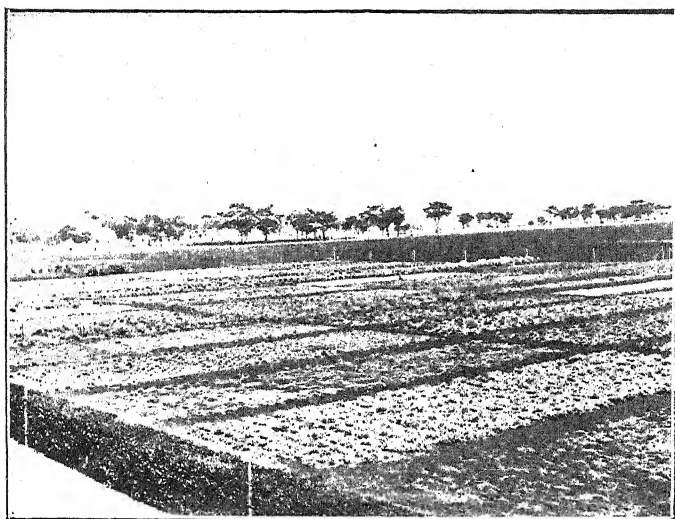
Napier fodder and kudzu vine grown for ensilage at Salisbury Experiment Station.



Napier fodder, showing growth after eight months' drought.  
Salisbury Experiment Station, November, 1923.







General view of the grass trial plots. Salisbury Experiment Station, November, 1923.



Niger oil (*Guizotia oleifera*). Salisbury Experiment Station.



**Variety Trials.**—Plots of the different varieties grown in Southern Rhodesia have been planted under uniform conditions for some years. This season the seed was planted on the 5th December, 1922, and the yields obtained were as follows:—

|                                | 1923. | 1922. | 1921. | 1920. | Average. |
|--------------------------------|-------|-------|-------|-------|----------|
|                                | Bags. | Bags. | Bags. | Bags. | Bags.    |
| Salisbury White ... ..         | 15.2  | 7.1   | 17.5  | 14.0  | 13.4     |
| Potchefstroom Pearl ... ..     | 16.1  | 8.3   | 17.1  | 12.8  | 13.5     |
| Hickory King ... ..            | 14.7  | 6.6   | 14.9  | 10.3  | 11.6     |
| Louisiana Hickory (10-row) ... | 13.5  | 9.1   | ...   | ...   | ...      |
| Texas Hickory (12-row) ... ..  | 15.2  | ...   | ...   | ...   | ...      |
| Menne (hybrid) ... ..          | 13.6  | 8.2   | ...   | ...   | ...      |

### INHERITANCE OF MAIZE CHARACTERS.

1. *Row-Numbers in Variety Trials.*—The following results are of interest as an illustration of the variations in row-number in our Rhodesian types of flat white maize. It will be observed that the variations from the standard type are very considerable in each case, Hickory King showing the greatest consistency to type, producing in this trial 63 per cent. of 8-row cobs. Texas Hickory showed the greatest divergence from type, producing only 41 per cent. of 12-row cobs.

|                            | Number of rows on ears. |      |      |      |      |      |      |
|----------------------------|-------------------------|------|------|------|------|------|------|
|                            | 6                       | 8    | 10   | 12   | 14   | 16   | 18   |
|                            | row.                    | row. | row. | row. | row. | row. | row. |
| Salisbury White ... ..     | ...                     | 47   | 151  | 289  | 89   | 16   | ...  |
| Potchefstroom Pearl ... .. | ...                     | 53   | 139  | 346  | 52   | 8    | ...  |
| Hickory King ... ..        | 29                      | 377  | 175  | 11   | ...  | ...  | ...  |
| Louisiana Hickory ... ..   | 7                       | 159  | 307  | 116  | 5    | ...  | ...  |
| Texas Hickory ... ..       | ...                     | 129  | 164  | 213  | 87   | ...  | ...  |
| Menne (hybrid) ... ..      | ...                     | ...  | 35   | 181  | 223  | 74   | 21   |

These figures should be read in conjunction with previous years' reports. Row-number as a character seems impossible of fixation in maize, but the variation from standard this season seems remarkably accentuated.

That much can be done by seed selection is shown by the results obtained at the Agricultural Experiment Station in 1919-20, when over a series of trials with Salisbury White a total of 75 per cent. of 12-row cobs was obtained from seed produced at the station, and 73.5 per cent. was got from seed supplied by Mr. Duncan Black.

Although results with row-character have proved variable, greater consistency has been attained with other important characters of the maize plant.

2. *Short Sheaths (i.e., with tips of ears exposed) and Long Sheaths.*—The inheritance of these characters would seem to be undoubted. Some difficulty presents itself in estimating results, as it may be said in a great many cases that the resulting cobs have neither short sheaths nor markedly long ones, but might more properly

be classed as intermediate. The results this season are consequently presented in the following form:—

|                                 | Resulting Cobs.  |                    |                   |
|---------------------------------|------------------|--------------------|-------------------|
|                                 | Long<br>Sheaths. | Inter-<br>mediate. | Short<br>Sheaths. |
| Seed from short-sheath cobs ... | 84               | 53                 | 60                |
| Seed from long-sheath cobs ...  | 126              | 58                 | 27                |

From which it is obvious that selection in the field of cobs with long sheaths will result in a considerable reduction of exposed tips with their attendant discoloured and damaged grain.

3. *Long Ears v. Short Ears.*—The difficulty in presenting results here again is due to the presence of intermediate forms. By placing the cobs into their respective classes the results appear quite clear. Salisbury White seed was used.

|                          | Resulting Cobs.    |                   |                   |                   |               |
|--------------------------|--------------------|-------------------|-------------------|-------------------|---------------|
|                          | Less than<br>6 in. | 6 in. to<br>7 in. | 7 in. to<br>8 in. | 8 in. to<br>9 in. | Over<br>9 in. |
| Seed from short ears ... | 97                 | 59                | 27                | 2                 | nil           |
| Seed from long ears ...  | 62                 | 44                | 68                | 16                | 5             |

Thus, taking 7 ins. as a reasonable average length of cob for the whole crop, the short ears gave 84 per cent. of cobs *below 7 ins.*, while the long ears gave 45 per cent. *above 7 ins.*

4. *Rough Grain v. Smooth Grain.*—The seed planted in this case was obtained from decidedly rough and smooth-grained cobs respectively, and the tendency to reproduce this character is clearly indicated in the results obtained:—

|                                  | Resulting Cobs. |               |        |
|----------------------------------|-----------------|---------------|--------|
|                                  | Smooth.         | Intermediate. | Rough. |
| Seed from rough-grained cobs ... | 14              | 67            | 30     |
| Seed from smooth-grained cobs    | 27              | 54            | 17     |

5. *Grain Discoloured with Brown Fungoid Spot.*—The presence of this discoloration has been a source of much anxiety to maize growers. Not only was the commercial value of the grain reduced for this reason, but it was feared that the causative fungus might be connected with the occurrence of diplodia in maize, and this point is now receiving the attention of the Mycologist. If this character was inheritable, seed so marked would be vitiated. The trials carried out during the past two seasons of extreme dryness and wetness respectively show that this character is not transmitted to the progeny to any extent, if at all, nor would it seem to be due to climatic or weather conditions.

|                                            | Resulting Cobs.                  |                                                                |
|--------------------------------------------|----------------------------------|----------------------------------------------------------------|
|                                            | 1921-22.                         | 1922-23.                                                       |
| Seed sown marked with<br>brown spot ... .. | 295 clean cobs<br>36 discoloured | 131 clean cobs<br>9 slightly discoloured<br>2 much discoloured |

**Maize and Velvet Beans, both for Grain.**—The growing of a double crop simultaneously for grain is a departure in the direction of intensive methods. Combining these two crops would obviously be advantageous, provided the yield of maize grain did not suffer. The idea has already proved successful in this country, while in the United States of America it is claimed that substantial returns of beans are obtained without impairing the yield of maize. The trials conducted this season indicated that while the maize crop did not suffer from the presence of the velvet bean, the bean crop itself seems to have made very little headway in the production of seed. In the present instance this was due to the excessive rainfall, which produced much disease among the foliage already shaded by the more vigorous maize plants. When grown alone, the velvet bean crops gave satisfactory yields of seed, as will be seen from the returns given elsewhere. The report on a similar method of growing *fodder* should, however, be read in this connection.

| Method of planting.                                                                                                                    | Yield of<br>maize per<br>acre. | Yield of<br>beans per<br>acre. |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------|
|                                                                                                                                        | Bags.                          | Lbs.                           |
| 1. Maize in rows 40 in. apart, with velvet beans in alternate rows between the maize. Sown simultaneously. All planted 19/12/22 ... .. | 20.0                           | 76                             |
| 2. Maize in rows 40 in. by 18 in. Beans planted in same rows 14 days later ...                                                         | 20.4                           | 32                             |
| 3. Maize 40 in. by 24 in. Beans in same rows planted 14 days later ... ..                                                              | 18.4                           | 88                             |
| 4. Maize 40 in. by 36 in. Beans in same rows planted 14 days later ... ..                                                              | 14.4                           | 48                             |

(To be continued.)

# Poultry Husbandry.

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## SOME COMMON DISEASES OF POULTRY.

(Continued.)

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By A. LITTLE, Poultry Expert.

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This series up to date has dealt with diseases of the respiratory system; these will be found in Bulletins Nos. 434 and 441, and in the issues of the *Rhodesia Agricultural Journal* for October, 1922, and December, 1922.

## DISEASES OF THE DIGESTIVE SYSTEM.

Before dealing with specific diseases, it is necessary to enumerate the organs of digestion, with their form, structure, situation and use. The food passes through the mouth, where it is moistened, into the œsophagus, where it is further moistened; then into the crop, or first stomach, which is really a dilatation of the œsophagus; it is here softened by the liquids secreted by the crop. From here the food passes into the lower part of the œsophagus, and from thence to the second or true stomach (*proventriculus*). Here it is mixed with the gastric juice, and then passes to the gizzard, which is a very firm thick muscular organ, in which the food is ground by pressing and rubbing it against hard sharp grit that the bird has swallowed. The food, after being subjected to this process, passes on to the small intestine, where it is mixed with secretions from the pancreas, liver and intestine, and so further digested.

**Inflammation of the Mucous Membrane of the Mouth.**—This may be caused by a cold, by some disease of the respiratory system, or some disease in which a feverish condition is set up. The chief symptom is dryness of the tongue and the mouth generally, and causes what is often called "pip." The dry condition of the mouth causes the tongue, which is thin, to become brown and hard. The old-fashioned remedy of what is called "taking off the pip" is not only cruel, but quite unnecessary; the remedy is to correct the abnormal condition of feverishness by giving the bird some laxative and moistening the mouth and tongue with glycerine, sweet oil or similar lubricant. In this ailment a hard deposit often accumulates on the tongue and along the ridges of the mouth.

*Cause.*—This, as mentioned above, is often the result of a cold or feverish condition; in addition, some irritation or injury may cause it, or it may be due to micro-organisms.

*Treatment.*—In addition to the treatment mentioned above with reference to the tongue, 20 grains of chlorate of potash with  $\frac{1}{2}$  oz. of glycerine and  $\frac{1}{2}$  oz. of water is beneficial, or 15 grains of boric acid powder dissolved in 1 oz. of water.

**Inflammation of the Crop.**—*Cause.*—Irregular feeding or gorging, irritation of the mucous lining due to eating feathers, etc., decomposed meat, bad food, poison or worms.

*Symptoms.*—Swelling of the crop, which is soft. (In crop binding it is hard; in enteritis like soft putty.) If rubbed between the finger and the thumb, there is a feeling as if the inner coat was slimy. This swelling is due to accumulated liquid or gas mixed with food. The bird is dull, listless and loses its appetite; it also becomes very weak. If the crop is pressed, liquid and gas are expelled through the mouth; these have an offensive odour due to fermentation.

*Treatment.*—Put the bird in a clean dry coop with a good bedding of litter. Empty the crop by holding the bird head downwards and press and manipulate the crop in order to press out the contents through the mouth; then give 2 grains of sub-nitrate of bismuth and half a grain of bicarbonate of soda in a teaspoonful of water. Keep the bird without food for 24 hours; then feed sparingly on soft, easily digested food. If taken in its early stages, recovery is practically certain.

**Crop Binding.**—The crop may be overloaded with food and distended, and so solidly packed that it cannot be emptied, especially if, as is so often the case, the outlet is clogged with leaves, straw or feathers, etc. The walls ultimately become paralysed.

*Cause.*—Improper feeding and irregular feeding. This leads to depraved appetite and the bird eats feathers, nails, large pieces of dry bone, thread, dry leaves and similar substances. Lack of sufficient drinking water also is a cause.

*Symptoms.*—Loss of appetite, difficulty in swallowing, distension and hardness of the crop (sometimes it is as large and as hard as a cricket ball). The bird is dull and sleepy and slow in its movements. The comb is pale, and often the mouth remains open. Asphyxia and gangrene may supervene.

*Treatment.*—(1) Sweet oil poured into the mouth, followed by massage of the crop to break up its contents. The bird should be held head downwards, and the loosened contents of the crop pressed out of the mouth. If this is continued, the crop may be emptied. If this treatment is not efficacious, then (2) the crop should be cut into with a sharp knife and the contents removed through the incision, which should not be more than one inch in length and in position fairly high. After the contents are removed the crop should be washed out with a solution of 5 drops of carbolic acid to 1 oz. of water and the wound stitched up, care being taken that the walls of the crop are first stitched separately, then the skin. For 24 hours after the operation give no



food and only a small quantity of water to which has been added 1 grain of salicylic acid. Afterwards give milk for three days, gradually getting on to soft and then harder food. Provided the condition is taken in time it is not serious, and when the bird is recovered there is no reason why it should not be bred from.

**Inflammation of the Stomach (Gastritis).**—This is not uncommon, and is often fatal.

*Cause.*—Anything which interferes with the proper digestion of the food, as, for instance, lack of grit, eating too large a quantity of food at one time, eating food that is too rich and concentrated, condiments, spices, condition powders, lack of exercise, dirty drinking water, mouldy food, tainted meat, irritant poisons such as dip, lime, phosphorus, etc. The disease is also often the accompaniment of diphtheritic roup, coccidiosis, etc.

*Symptoms.*—Thirst and lack of appetite, dulness, feverishness, accelerated breathing, ruffled plumage, drooping wings, emaciation, constipation and weakness.

*Treatment.*—Correct conditions. Give easily digested food, feed regularly, often, and a little at a time. Give barley water or milk to drink, or if water is given put in 20 grains of bicarbonate of soda to a quart. Give Epsom salts once a day as long as necessary, and let the birds out on free range. Gastritis may also be caused by pins, nails or other sharp objects becoming lodged in the stomach and perforating the walls; in this case the bird usually dies very quickly.

**Enteritis.**—There are three forms of enteritis or inflammation of the intestines, viz.: (1) simple inflammation of the digestive tract; (2) toxic enteritis; (3) bacterial enteritis.

(1) *Simple Enteritis or Inflammation of the Digestive Tract.*—

*Cause.*—Too large an amount of food, poor quality food, exposure to cold or wet weather. Other causes may also account for the condition, e.g., too concentrated or rich a food, tainted or mouldy food, dirty drinking water or water that has been standing in the sun or heat, pepper, mustard or spices, exposure to draughts, especially when moulting.

*Symptoms.*—Soft whitish or yellowish droppings, which gradually become more liquid. The bird is thirsty, feverish, with no appetite, and loses its activity. The feathers are ruffled, the crop large, and the bird, if not taken in hand at once, becomes weaker and more exhausted, and soon dies.

*Treatment.*—If the disease is diagnosed at once, the bird can be cured, but if not it is best to kill it and burn the body. The main thing is to correct the conditions which have been the cause of the illness. The food of the sick bird should consist of small quantities of dry mash or well-cooked food, with some chopped raw meat. Give milk to drink or water with some oatmeal in it. First give one tablespoonful of sweet or salad oil, followed by  $\frac{1}{2}$  gr. bicarbonate of soda and 2 grs. of sub-nitrate of bismuth in a little water three times a day. If diarrhoea is severe, add to this  $\frac{1}{8}$  gr. powdered opium.

(2) *Toxic Enteritis*.—This is acute inflammation of the intestines.

*Cause*.—The partaking of irritant poisons, such as lime (unslaked), salt in appreciable quantity, nitrate of soda, dips of various sorts, lead, copper, arsenic, zinc, phosphorus, etc.

*Symptoms*.—Redness in the mouth and throat, diarrhoea, convulsions, sleepiness, ruffled feathers. The bird usually seeks a dark, quiet place away from its companions.

*Treatment*.—Treat as for simple enteritis, but for different poisons the necessary antidotes should in addition be given. For instance, in the case of salt; nitrate of soda and lime give infusion of flax seed and strong coffee. In the case of arsenic, give sulphate of iron, magnesia, white of egg and infusion of flax seed. In the case of lead, copper, zinc and phosphorus, give white of egg. Charcoal too is good in the case of phosphorus, and sulphate of soda or potash in the case of lead. Ergot of rye is a vegetable poison that causes enteritis, the symptoms being trembling, giddiness, weakness and ulceration of the comb, beak and tongue; in this case coffee or camphor should be given.

(3) *Bacterial Enteritis*.—This occurs in fowls, turkeys, ducks and other birds, and is often mistaken for cholera. It is one of the most fatal diseases that poultry are subject to.

*Cause*.—Certain bacteria and bacilli, among which is the *bacillus gallinarum*. The infection spreads through contaminated food and water. This bacillus may be found in the liver, kidneys and blood, as well as in the intestine. Another, a spiral shaped germ, is also the cause. This attaches itself especially to chickens and may be introduced through the larynx or oesophagus, but it always finds its way into the intestines. Yet another is found in the intestines, heart, liver, spleen and blood.

*Symptoms*.—Thirst, lack of appetite, dulness, slow gait, diarrhoea—at first solid and of a greenish colour, later soft, liquid and yellowish green. The comb is usually pale, the wings droop, the feathers are ruffled, the head is held low and the eyes are closed. Sometimes the droppings contain blood. Finally the comb becomes purple, the bird is with difficulty roused and finally it dies.

There are two forms: the acute, in which the birds die in from one to two weeks after they are attacked, and sometimes earlier, and the chronic form, where the birds are ailing for from three to four weeks before they die.

*Post mortem* appearances in the acute form are a large and congested liver; the spleen is large, but light in colour; the intestines, especially the appendices, are red in colour. The only difference in the *post mortem* appearances in the acute and chronic form is that in the latter the liver is smaller than normal.

*Treatment*.—Immediately the disease is diagnosed, the surest method of stamping it out is by killing those birds that are ill and burning the carcasses. Carefully watch the remainder, and immediately one shows the slightest appearance of being out of sorts it should be isolated and given a pill of 3 grs. of sub-nitrate of bismuth, 1 gr. of

powdered cinnamon or cloves and 3 grs. of powdered charcoal mixed with flour and water twice a day. If in three days the bird has not improved it is best to kill it. A few drops of Kerol or similar disinfectant should also be put into the drinking water. The food given should not be large in quantity. The best is mealie meal, rice flour or dry bread mixed with boiled milk into a stiff paste, with a little boiled and finely chopped meat or hard boiled egg. As this is a most infectious disease, all houses and runs should be cleaned and disinfected. The floor and buildings should be saturated with a 5 per cent. solution of carbolic acid; the drinking and feeding vessels should be thoroughly scalded with boiling water. This disinfection should be frequently repeated till the disease disappears, when all houses should be thoroughly lime washed.

**Prevention.**—Absolute cleanliness should be observed in houses, runs, food and water vessels, etc. Drinking water should always be clean and the food good. One of the causes is allowing the fowls to have access to stagnant pools, rotten grain or decayed green food, putrid meat, etc. The disease is often introduced with sick fowls that are brought on to the place. Any new bird should always be dipped on arrival and quarantined for three weeks. Bacterial enteritis is a most rapid and destructive disease, and 50 per cent. to 80 per cent. of the birds may die before it is checked if early diagnosis and precautions to deal with it drastically and promptly are not taken. The drastic method of killing all affected birds and burning the bodies is the best and most economical in the long run.

**Coccidiosis or Entero-Hepatitis.**—This disease, affecting poultry and some wild birds, is sometimes called "Liver Trouble," "Spotted Liver" or "Cholera," and "Blackhead" in turkeys. It is most contagious, and outbreaks of it usually occur towards the end of a long, hot, dry season, and also shortly before the rainy season commences, i.e., from September to December. Once it obtains a hold in a district it may rapidly annihilate large numbers of fowls, and it therefore behoves the poultry keeper to be on the *qui vive* for it and act immediately, especially as it has occurred in several districts in the country.

The disease affects turkeys, fowls, guinea fowl, pigeons, geese, ducks, pheasants, quail, grouse and sparrows, therefore it is particularly important that poultry keepers should take precautions should they hear of these wild birds dying in a district or that the fowls, etc., are suffering from any serious disease in their vicinity.

**Mode of Infection.**—The germs, which rapidly increase in the body of the bird, are voided in millions in the droppings; these on the feet of the fowls or attendants are carried over the area where the fowls range and are picked up by them in the drinking water and food. Similarly wild birds contaminated with the disease spread it by flying into and settling on the ground in runs or where fowls are ranging.

**Cause.**—This is due to a micro-organism which has a very complicated life history, going through fifteen different changes before it becomes mature. It multiplies very rapidly in the intestines of the diseased birds, causing redness and thickening of the

intestinal wall; the walls of the cæca are frequently thickened and contain a whitish, yellowish or greenish-yellow pasty mass. If the disease is not rapidly fatal (which is usually the case), it may extend to the liver and lungs, where it is recognised by whitish or yellowish spots or by large cheesy nodules. When the liver is affected it becomes covered by whitish-yellowish patches.

*Symptoms.*—The disease presents three symptoms which are invariable, viz.:—

- (1) Diarrhoea at some stage of the disease.
- (2) A condition of increasing languour or stupor, dulness and weakness; tail and wings appear droopy, feathers become ruffled.
- (3) Loss of appetite, emaciation and rapid weakness, ending in death from three to ten days after showing the first symptoms.

The droppings are first watery, then slimy, then of a greenish-yellow colour, with traces of blood in them or chalky material.

The disease usually follows three courses:—

(1) *The Acute Form*, which is more likely to attack the younger birds, frequently causing a mortality of from 80 to 90 per cent., while the older birds prove more resistant. Death occurs from the third to the seventh day after the onset; those that survive after the fifteenth day do not usually die, but remain delicate for a very long time.

(2) *The Slowly Progressive Form.*—The disease may be present in a flock, but does not at once assume the acute form; it is likely to remain latent in them, so to speak, or to change into a slowly progressive form, which may not cause death for several months.

(3) *The Chronic Form.*—In this the birds hold their own against the disease for a long period extending over a year or more, during which time the emaciation gradually increases. In these birds the disease is ultimately fatal in the majority of cases.

In geese the kidneys are affected, and the birds lose flesh rapidly without apparent cause and become very weak and almost unable to walk. They remain quiet with the belly resting on the ground, or lie on their backs with the feet widely separated; they lose their appetites and become weaker till they die.

*Treatment.*—The birds do not usually respond satisfactorily to treatment. However, internal antiseptics are indicated, as, for instance, permanganate of potash (a fairly strong solution— $\frac{1}{4}$  oz. to a gallon), or Kerol or Lysol (a few drops only) in the drinking water.

The most successful treatment is that of a teaspoonful of powdered catechu in each gallon of drinking water, or one teaspoonful of tincture of catechu to a quart of drinking water. A carminative pill of the size of a pea, to which is added some tincture of catechu, in the following proportions:—Carminative powder, 2 grs.; tincture of catechu, one small teaspoonful.

The poultry keeper should concentrate all his energies upon preventing the disease getting a hold on his birds or its spreading if it does get among them.

*Prevention.*—If the disease has not affected any birds, but is in the district or even some distance away, all houses, runs, coops, etc., should be disinfected daily by spraying well with a 2 per cent. solution of Kerol or similar disinfectant and hot water. All drinking vessels and food utensils should be washed and thoroughly disinfected each day. Wild birds, pigeons, etc., should be rigorously kept away from the poultry houses and runs. Any new bird coming in should, before being placed with the others, be dipped, isolated for a week and then dipped again. Immediately a bird is noticed showing signs of illness or even a bit mopy, it should be isolated at once, placed in a dry, well-ventilated place free from colds and draughts, and fed sparingly on soft food. As rats and mice also carry the parasite, care should be taken to keep houses, etc., free from these. All drinking water should contain Kerol, Lysol or tincture of catechu—a few drops of each—or permanganate of potash or powdered catechu.

If the disease has appeared among the birds, in addition to the above precautions, any bird that is at all seriously ill should at once be killed and its carcase *burned*. Careful inspection of the birds should be carried out as many times a day as possible, and immediately one shows the slightest sign of illness it should be isolated and carefully watched. Watch too must be kept for droppings of the nature present in the disease. Catechu can be obtained from any chemist.

Recovery is rare, and even those birds that do recover are lowered in vitality and delicate for a long time. Once a bird of low vitality contracts the disease, cure is practically hopeless, but those of strong vitality and vigorous will, if treatment is undertaken *immediately*, probably recover.

It will be seen from the above that this disease is a very serious one. It is in fact the most serious we have among poultry, rapidly carrying off large numbers of birds, and especially those that are not kept in a sanitary condition, housed and fed properly. It is a poultry scourge that breeders should always be prepared for, and it depends upon the poultry keepers of the country individually and collectively chiefly as to when and how soon it can be stamped out. The more care given to cleanliness, proper housing and feeding, the sooner will this object be attained.

# Elephant Grass (Napier Fodder).

(*PENNISETUM PURPUREUM*.)

By H. W. POTTS, F.C.S., F.L.S.

The following article appeared in the *Pastoral Review* of Australia for September, 1923, and will no doubt be read with interest by Rhodesian farmers.

The author is, however, in error in supposing that only one parcel of Napier fodder has been sent to Australia. The Department of Agriculture, Salisbury, in addition to the first parcel referred to, sent at least ten other consignments of seed and roots to the Government and to leading seedsmen in Australia between the years 1914 and 1920, from which no doubt this plant has been established in many parts of the Commonwealth.

"The seed of this grass was imported by the Department of Agriculture of New South Wales from Central Africa in 1914, in consequence of a report furnished by the writer to the Under-Secretary, Mr. Geo. Valder. The report was the outcome of several conversations relating to the usefulness of the grass and its value as a stock fodder for periods of scarcity, held with the Director of Agriculture of Rhodesia, who visited the Hawkesbury Agricultural College in 1913, and also discussions with Mr. McKinnon, police magistrate at Zambesi. Both these gentlemen were impressed with the possibilities of the grass for our large grazing areas in feeding stock, and suggested our testing it.

"It is worthy of note that out of the parcel of seed received and placed in the hands of the then Department's Agrostologist, Mr. Breakwell, B.A., B.Sc., for propagation, only one seed germinated. From that single plant distribution has been made throughout Australia. Sample packets of roots were also sent to California in response to requests, and now we find it has attracted attention and is being grown in Colorado, Georgia, Florida and other parts of the United States.

"In New South Wales the Department of Agriculture, under Mr. Breakwell's supervision, had the grass tested in suitable areas at the Hawkesbury College and a number of the experiment farms, as well as by over 100 graziers and farmers, who have since furnished favourable reports. Mr. Whittet, the present Agrostologist, is continuing the experimental work in various aspects at the Hawkesbury College and elsewhere.

"The *Kew Bulletin*, 1912, describes the grass as a native of tropical Africa, where it has acquired a favourable reputation as a cattle fodder. It is found growing luxuriantly over vast areas, and along the delta of the Zambesi it forms extensive reed jungles. It grows freely along the borders of Rhodesia, and is found at a height of 5,500 ft. in sheltered localities.

"It is a perennial grass and grows in clumps of from 20 to 200 stalks up to an inch in diameter and 10 to 22 ft. tall. It is a common occurrence to find this grass growing in rich marsh lands 20 ft. high, but in dry soils of a poorer character it grows as low as 6 ft.

"In Africa, and especially in Rhodesia, this grass has acquired a reputation for producing a good class of fodder, suitable for cattle and horses during periods of drought. There it is known as Napier's Fodder or Napier's Wonder Grass, and is called after Colonel Napier, who has described its value in dry seasons.

"In Togoland it is called Elephant Grass.

"Four years after the arrival of the seed in New South Wales a sheaf of the grass, grown at the Hawkesbury Agricultural College, standing over 12 ft. high, and exhibited at the Royal Agricultural Society's show, attracted much attention. Mr. Breakwell, in his annual report for 1918, states:—"The success of elephant grass has been somewhat remarkable. In appearance it is most unpromising, but there is no doubt about its palatability, nutritive qualities and quickness of growth for coastal districts."

"Our farmers, as also those in Southern Rhodesia, are beginning to realise that it is a fodder worthy of much attention. The results of analysis tend to show that it is richer in food nutrients than green maize, and has about the same feeding value as Timothy grass.

"It can be used as green feed, and when cut 3 to 4 ft. high it makes a good quality hay. In tests conducted at Hawkesbury, N.S.W., and Georgia, U.S.A., fair silage was made from it, although some of the stems were too woody. It gives a yield in New South Wales, according to the age of the plant and the character of the soil, ranging from 12 to 20 tons to the acre. The Florida Station, U.S.A., reports yields of 19½ to 30 tons per acre of feed. It has, in all the tests conducted, exhibited remarkable powers in resisting drought, and is found to be hardy in resisting frosts.

"It grows in tussocks and stools very freely. The stems beyond a height of 6 or 7 ft. become harsh and woody, but despite this they have been shown to be nutritious, and equal in food value to maize stalks.

"Elephant grass grows best on sandy, alluvial or volcanic loams, but it adapts itself to poor barren soils with payable results. It grows with unusual rapidity and strength where moisture is abundant in summer, and has been known to sprout 2 ft. in a week.

"In the western districts of New South Wales it is usually found to grow about 6 ft. high. A single cutting planted has been known to produce 40 to 50 stalks in a season.

"The experience at Hawkesbury College and other centres during

the last severe drought proved it to be a drought-resistant grass, seeing the yields for the season totalled 20 tons of feed to the acre. It has been proved, however, that it will not endure hot winds and the extreme heat of summer on the western plains.

"For dairying purposes the best results are obtained when the grass is grazed before reaching a height of 3 ft.—an average of 2 ft. being best. Cows maintain their full milking capacity on it, as well as the butter fat percentage. These results have been confirmed in the United States. In our wheat areas the fodder has been found serviceable as a summer feed, and in this connection may be relied on to produce 60 or 70 tons of green feed per acre in a season.

"Elephant grass can be propagated by means of seed, cuttings or rooted slips. The latter is the surest way to establish a plot. The root suckers freely, and may be divided into a number of rooted slips. They should be planted out in rows 6 ft. apart and 3 ft. between each plant. Where time is not a desideratum, it is a good plan to plant them 6 ft. apart. In two years, in good soil, they will stool close together. In such a case it will require 1,200 plants for one acre.

"Where cuttings are used they should be selected from fairly hard portions of the plant stem or cane, and should each have three nodes. Plant these 3 ft. apart with two nodes in the soil and one out. If it is desired to put in a quantity, plough shallow furrows 3 ft. apart, drop the cuttings horizontally in the furrows, the ridged soil being turned back upon the cuttings by reversing the direction of the plough.

"When stock eat off the top leaves and succulent portions of the stalks, tender shoots spring out, which become available later. The grass grows freely and rapidly in early spring, and should be eaten off or converted into hay before it becomes too coarse.

"During a dry spell sheep will eat the feed, although they prefer natural grasses. This emphasises the claim made that the elephant grass is a useful fodder in time of drought. It is not professed that it will replace any of our native grasses in point of palatability or food value, but in dry spells, when natural feed fails, we are inclined to believe that elephant grass is worthy of a serious trial. It may prove a potent factor in assisting to solve the most urgent of our problems during drought.

"We have the assurance of reliable experts that elephant grass or Napier's fodder has acquired a reputation for supplying a tasty class of fodder with good nutritive food values far ahead of gum leaves during periods of great scarcity of rainfall in Central Africa and Rhodesia.

"The natural habits of the grass lend themselves to meet such conditions in Australia, as has already been proved by many graziers. It is a grass of unusual vigour and hardiness, with drought-resistant qualities. The plan has been adopted of planting patches along the banks of rivers, creeks, water holes, billabongs, swamps and through depressions where the alluvial soil is deep and with permanent soakage providing moisture to a good depth.

"The grass has a vigorous root system, and can reach moisture at great depths."



## Cross-bred Pigs for Bacon.

As there seem to be many different opinions as to the best cross for bacon pigs, it was thought advisable to get information from various authorities on this point.

Mr. George Neill, of Neill's Bacon Factory, Salisbury, and also Mr. H. K. Kimpton, of Kimpton's Bacon Factory, Bulawayo, prefer the Berkshire-Large Black cross, whilst Mr. Maxwell, of the Farmers' Co-op. Bacon Factory, Salisbury, is a great advocate of the Middle White pig, either pure or crossed with the Large Black, as giving the ideal baconer.

Mr. Maxwell, of the Farmers' Co-op., Ltd., Bacon Factory, Salisbury, writes as follows:—

"For cross-breeding purposes the Large Black holds premier place in South Africa. In the writer's opinion this should not be, for if this country is to take its rightful place in the live and dead meat markets as producers, it must throw prejudice to one side and adopt the white pig as its standard to the extent of 60 per cent. of its production.

"In the largest markets of the world one finds the white and spotted pigs hold predominance, and there is no reason why the same conditions should not hold good in this country.

"Colour is an absolute necessity for marketing purposes, both for pork and bacon. The white pig shows a uniform level of flesh and fat and a more even level on the back and in the streaky and belly.

"The most favoured case of cross-breeding in South Africa is the pure-bred Berkshire boar on the Large Black sow. What I would like to see is the Middle White boar put to the Large Black sow, which would give mostly a white production.

"My reason for advocating the white pig is that it produces a finer skin and better texture of meat and fat. My opinion is based on my American experience. There a full 80 per cent. of the pigs are white, and the conditions are much more severe and trying to the pig producer. The temperature is something like our African climate, but much more severe towards the fall of the season, where it falls from extreme heat to extreme cold in a matter of a few hours."

Other authorities are quoted for general information.

Messrs. Sparks & Young, Ltd., of Durban, in their brochure, "Thirty pages for the Guidance of Pig Breeders," write as follows: "At the present time there seems to be a great diversity of opinion as to the relative excellence, as baconers, of Berkshire-Large Black and Berkshire-Tamworth crosses. From our experience the best results are

obtained from the Berkshire-Tamworth cross, which produces the ideal streaky bacon; and with the object of encouraging farmers to confine themselves to this breed, we are to-day offering a higher price for Berkshire-Tamworth cross baconers than for any other class of stock."

The Principal of Elsenburg writes:—

"At Elsenburg we prefer the Berkshire-Large Black or Tamworth-Large Black cross. I am aware that Messrs. Sparks & Young, Durban, favour the Berkshire-Tamworth cross, and this cross undoubtedly produces a very fine bacon pig, but I doubt whether it is as satisfactory from the farmers' point of view as are the other crosses. There is a striking difference of opinion among curers as to which is the best cross. Messrs. Hiscock's, Ltd., Wellington, favour the Berkshire-Large Black. The Imperial Cold Storage, who are both breeders and curers, appear to prefer the Tamworth-Large Black. I believe the Estcourt Factory advocates the Middle White-Large Black.

"Personally I consider that the curers are inclined to attribute to one particular cross credit which should be given to the breeder. A breeder who understands what a bacon pig should be will select his boar so as to correct the defects of his sows from a bacon point of view, and so turn out a first-class baconer whatever cross he may favour.

"Our reasons for preferring the Berkshire-Large Black or Tamworth-Large Black are as follows:—

"We prefer the Large Black sow because we consider that it is the best mother, combining fertility and fecundity with a quiet disposition and excellent milking qualities. As regards the boar, that all depends upon the sows. If the sows are long, lacking in depth and light in shoulder and ham, the best boar will be the Berkshire; and it will not much matter if he is a little heavy in shoulder and jowl, provided he has plenty of depth and good hams. On the other hand, if the sows we have selected are lacking in length and rather heavy in shoulder and jowl, but have depth and good hams, we would prefer to use a Tamworth boar.

"On any of our big shows Large Blacks of either type may be seen, and the folly of mating the first type to a Tamworth boar or the second to a Berkshire boar will be readily recognised.

"As regards the Middle White-Large Black, our objection to this cross is on account of the white, which is more liable to sun-scald. In fairness to the Middle White, it must be admitted that excellent results in Natal have been obtained from this cross, and breeders there claim that they are not affected by sun-scald, and have the advantage that white pigs do not have 'seedy belly'—a fault of which black pigs are accused.

"Our objection to the Berkshire-Tamworth is that we do not consider the Tamworth as good a mother as the Large Black. From the above it will be seen that the production of a first-class baconer does not depend so much upon the cross as a knowledge of what a bacon pig should be, and then the intelligent selection of the sows, so as to have uniformity of type, and the correct choice of the boar to mate to them.

"The advocacy of any one cross has always seemed to me to be rather dangerous, as many farmers, persuaded to adopt a certain cross, consider that that is the Alpha and Omega of the business. They write to a breeder for their sows and to another for their boar. Sometimes the result is successful; more often it is not, and the cross is blamed. Under such conditions it is not surprising that the bacon factories are dissatisfied with the pigs received at their factories, and the only remedy would appear to be the education of the farmer as to the correct conformation of a baconer in the importance of the selection of the sire to mate to his sows so as to come as near as possible to a standard type of baconer."

Mr. W. P. Bawden, Managing Director of the Estcourt Bacon Factory, who is well known to Rhodesian pig breeders, writes:—

"We experiment here in the matter of breeding to a fairly large extent, and have found any of the following crosses suitable: Middle White-Tamworth, Middle White-Large Black, Middle White-Large White, Large White-Berkshire. If fed properly, any of these crosses may be manufactured into first-class bacon.

"There is some objection in parts of the Union to the use of white pigs. In Natal we find farmers taking to them very kindly, and we are doing our best to encourage white breeds wherever possible. The objection to the white pigs appears to be a liability to sun-scald. This has even been put forward as an objection by one of the Government experts of the Union; but so far in Natal we have not been troubled with sun-scald, and pigs of these breeds are being raised with success in large numbers on the Tugela Estates, which is one of the hottest parts of Natal.

"I am aware, of course, that Messrs. Sparks & Young, of Durban, are offering their highest price for Berkshire-Tamworth crosses. This is also an excellent cross, but too frequently bears the characteristics of the Berkshire, that is, showing too great a percentage of fat, with short three-quarter side and a heavy shoulder.

"The Berkshire-Middle White should not be crossed if intended for bacon purposes because of its producing too great a percentage of fat; neither should the Large White and Large Black be crossed, because they become too heavy before being mature."

Mr. S. Hiscock, Managing Director of the Wellington Bacon Factory, writes:—

"We have pleasure in saying that we have always recommended the Large Black sow and Berkshire boar because this cross matures quickly and gives better returns to farmers and curers alike.

"The Tamworth-Berkshires are equally good, but Tamworth sows do not keep their condition in this country, and they are also difficult to obtain.

"Middle White boars on Large Black sows are well reported upon from Natal, but are not a success here.

"Following on Loudon M. Douglas' advice, given me on leaving London twelve years ago, I have no reason to doubt the efficiency of the Large Black and Berkshire cross."

The Assistant Manager of the Nel's Rust Bacon Factory writes:

"We carefully note your remarks, and in reply thereto would state that from our experience we have found that the Large Black sow crossed with the Berkshire boar produces a very good bacon pig, and a cross which we recommend. The Large Black is a good mother and generally throws large litters, and the pigs come to within bacon weights at an early age. There does not appear to be any pure-bred pig at present to meet the requirements of the factory when within bacon weights, and we have found it necessary to cross. The Large Black has length, but is rather deficient in the flank, but by crossing same with the Berkshire we obtain a good class of baconer.

"The Tamworth-Berkshire is also a very good cross, and excellent baconers are obtained, but they take rather longer to come within bacon weights than the Large Black-Berkshire.

"It is rather difficult to state which is the best cross for bacon purposes, as a great deal depends upon the feeding, etc., by the producer, but we feel confident that if either of the above two crosses is used you will find that excellent baconers are produced which meet the requirements of the factory."

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## Irrigation and Engineering Notes.

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Irrigation work has been brisk during the past few months, and it is gratifying to observe the number of schemes, both large and small, which are being constructed and are under consideration. In spite of bad times, many farmers are realising that sitting still means going backwards, so they are undertaking all such development as they are able to afford on any promising schemes in the hope of taking advantage of the markets as soon as these improve.

A reduction has recently been made in the price of local cement, and this can now be obtained f.o.r. Salisbury at 15s. per bag for small lots and about 14s. per bag truck load lots. While every reduction in price is of some assistance in reducing the cost of works, the price is still on the high side, and it is hoped that further reductions may yet be made. The cost of 1, 3, 6 concrete, using local cement

on an ordinary country job here, is about 45s. per cubic yard, as compared with about 32s. per cubic yard in the Union. This places an undue handicap on many works constructed here.

**Water Courts.**—There have been six sessions of the Water Court this year, and about 121 cases have been dealt with. The Court has visited farms and heard cases in nearly every district in Rhodesia. During the course of its inspection of irrigated lands, the great tendency that exists to irrigate more land than can be properly managed, and for which manure is available, has been noticed. Many farmers apparently do not yet realise that 20 acres of land well done gives as good results as 40 acres improperly done. The Court, in travelling over such a large area of country and visiting so many farms, has had opportunities of judging of the general conditions existing amongst the farming community, and has been much impressed with the serious economic conditions under which most farmers are struggling to-day. It becomes increasingly evident that dairying and pigs will have to be the basis of farming operations in many parts of Rhodesia in the future, as so much of the country appears suitable for little else. No efforts will have to be spared in establishing without delay outlets overseas for these products, otherwise it is difficult to see how many farmers will weather the difficult times through which we are passing.

### SCHEMES UNDER CONSTRUCTION AND COMPLETED.

**Popotekwe River Scheme, Ballinahone.**—This scheme is now completed and ready for operation. Opportunity has been taken of the low state of the river during October to build the weir, which is of the semi-permanent boulder net type. It is the intention of Capt. Prior to utilise the land under irrigation—about 40 acres—for both summer and winter crops, irrigation for the former being frequently necessary with the uncertain rainfall in the Victoria district.

**Chinyika River Scheme, Chinyika.**—A hydraulic ram has been installed in this river which is capable of lifting about 100,000 gallons of water per 24 hours against a head of 30 feet. The ram when tested was found capable of performing the full duty, and the scheme is now in operation and the water brought to the land. It is hoped that Mr. Vaughan Clark will receive reward for his enterprise.

**Avonduur Scheme, Mazoe River.**—Mr. R. S. Newett has recently installed a Blake's hydraulic ram in the Mazoe River which is capable of lifting under actual working conditions about 50,000 gallons per 24 hours against a head of over 100 feet. The pipe line discharges into a 75,000 gallon brick-built reservoir near the house, which it is intended to utilise for the irrigation of a garden and about 10 acres of citrus.

**Old Umtali Irrigation Scheme.**—The Irrigation Board has now been formally constituted, and no time has been lost in commencing the work. A contract has been let to Mr. C. J. P. Waller for the construction of seventeen miles of canal, and a large gang started to work in October. This scheme, which takes water from the canal of

the Odzani Irrigation Board, will command over 700 acres of good red soil at Old Umtali, an area which has always been regarded as eminently suitable for dairying and closer settlement.

**Umtali River Irrigation Scheme.**—Interest is again being taken in this scheme, and Col. Valentine, who has taken over the farm Battery Spruit, has been able to get the consent of the other owners to go on with the work. The scheme has always been regarded as one of considerable promise, as there is ample water and good land available upon which it can be used. Here is another ideal closer settlement area for dairying, pigs, etc.

**Umwindsi River Scheme, Ceres.**—Mr. A. R. Morkel has now seriously commenced work on this scheme. The tunnel approaches have been cut and the excavation work on the main canal is in hand. As soon as the steel work for the reinforced concrete tunnel linings arrives from England, the driving of the tunnel will be commenced without delay. This scheme has been referred to as one of the finest in Rhodesia, and probably the land to be irrigated has no superior this side of the Equator.

**Wataikai River Storage Scheme.**—The construction of the 10 feet storage weir is practically completed. The volume of water impounded by this work is very limited, but will be of real value in supporting the normal flow of the river. The scheme commands 80 acres of citrus trees, about half of which are bearing, and during the past season about 2,000 boxes of fruit were exported.

**Mazoe Dam.**—Extensive repair work was found necessary on the right bank spillway after last season's floods. The matter was carefully investigated by the irrigation officers of this Department in collaboration with the B.S.A. Co.'s engineer, and certain repairs which were recommended have been carried out. It must be pointed out that in the initial construction of the dam the spillway work was not carried to finality, it being the intention to allow one or two seasons' floods to pass over the wall before determining the final work.

**Cleveland Dam, Salisbury.**—The Government Irrigation Engineer, at the request of the Salisbury Municipality, was one of the Committee of Enquiry into the failure of this dam. In addition to reviewing the causes of failure, the committee made certain recommendations for the repair work. These repairs are now in hand under the municipality's resident engineer, and it is hoped to make the work safe before the heavy rains occur.

**Water Supplies in Native Reserves.**—Boring and well-sinking work has been pushed on energetically this season in the Gwaai, Nata, Raditladi's and Gwanda Reserves, and good results obtained except in the Raditladi's, where conditions for underground water supplies are not very favourable. Eleven windmills have been erected and ten reinforced concrete storage tanks with troughs installed. A survey of the occupied portion of the Gwaai Reserve has been also taken in hand, and about 150 square miles of country have been traversed, embracing all salient features of the area. The maps which will be prepared from this survey will be of great help to the Native Department in making these areas available for native settlement.

## Land Titles in Southern Rhodesia.

We publish below the new Agreement of Purchase of land in Southern Rhodesia as finally approved by the Cabinet:—

REGISTERED NO.

DISTRICT

FARM

COLONY OF SOUTHERN RHODESIA.

### AGREEMENT OF PURCHASE.

THIS IS TO CERTIFY that  
(hereinafter called the Purchaser) hereby agrees to purchase a certain  
piece of land, in extent                      morgen and                      square  
roods, named                      situate in the District of  
upon the following conditions:—

- I. (a) The purchase price of the land shall be £                      :                      :  
(                      ), which,  
together with interest thereon at the rate of five pounds per  
centum per annum, shall be paid by the Purchaser in equal  
half-yearly instalments of £                      :                      : (                      ),  
the first instalment being  
payable by the Purchaser on the                      day of  
19                      ; and the subsequent instal-  
ments being payable at intervals of six months thereafter on  
the                      day of  
and the                      day of                      in that  
and the following years up to and including the  
day of                      19                      , the instalments being so  
calculated and fixed that the said capital sum and interest  
shall be wholly paid off in a period of                      years  
from the said                      day of                      19                      .
- (b) The Purchaser may at any time during the currency of this  
Agreement pay any additional instalment of the purchase price.
- (c) Interest at the rate of five pounds per centum per annum shall  
be payable on any instalment which shall not have been paid  
on the due date.
- (d) On completion of purchase the Purchaser shall be entitled to  
obtain and receive a grant of the said land. The grant shall  
be subject to the payment of an annual quitrent of one shilling  
for each twenty-five morgen or portion thereof of land granted,  
and to conditions similar to those contained in Clauses XI.  
to XVIII. hereof inclusive.

G.B.

II. The Purchaser shall actually and continuously occupy the said land during the currency of this Agreement either personally or by a European substitute to be approved of by the Minister of Agriculture and Lands (hereinafter called the Minister) in writing, and shall carry out *bona fide* farming operations as follows:—

A. By the erection of permanent substantial farm buildings or other permanent improvements to the value of not less than  
£ : : ( ) ; or

B. During each year—

- (a) by the cultivation of three morgen of land for every hundred morgen of the said land; or
- (b) by the maintenance of three head of breeding cattle or fifteen head of small stock, comprising sheep, goats or pigs, for every hundred morgen of the said land; or
- (c) by the performance of a proportionate part of the requirements of sections (a) and (b) above.

Provided that during the first year of this Agreement the Purchaser need only carry out a one-half part of any one of the conditions specified under A and B above.

C. If before the expiration of five years the Purchaser shall, by reason of having paid his full purchase price and fulfilled the occupation conditions applicable to date of such payment, be entitled to claim a grant of the said land as under Clause I. hereof, he shall continue until the expiration of the said five years to occupy the land in a *bona fide* and beneficial manner as set out in sections A and B of this clause.

III. The rights hereby granted, or any part of them, shall not be alienated, assigned, sub-let, pledged or hypothecated except with the approval of the Minister in writing.

IV. In the case of death or insolvency of the Purchaser, his executor or the trustee of his estate may, with the written consent of the Minister, alienate his rights for the residue of the term.

V. In the event of any breach or non-observance by the Purchaser of any of the conditions of this Agreement, the Governor reserves to himself the right to cancel this Agreement and to resume possession of the said land, and in such case the Purchaser shall not be entitled to claim a refund of any moneys which he may have paid in any way whatsoever nor to claim compensation for any improvements effected upon the said land.

VI. Notwithstanding that the Governor may in the exercise of his rights cancel this Agreement, the Purchaser shall remain liable to satisfy any obligation he may have incurred before such cancellation.

VII. The Purchaser shall assume all and singular the rights and obligations of an owner of land in respect of fencing of any description that may be called for or erected under any law in force within the Colony applicable to the erection, maintenance or use of such fencing.

VIII. The Minister, or any person authorised by him, shall at all times have the right of entry upon the said land for the purpose



of inspection of the occupation carried out on the land, and to ascertain by such means as he may think fit whether or not the Purchaser has occupied and is occupying such land in accordance with the conditions of this Agreement.

IX. The Purchaser shall pay all such rates, taxes, assessments and impositions whatever as may hereafter become leviable in respect of the said land according to law.

X. Any natives who may be cultivating or otherwise occupying any portion of the said land, and whom it may be desired to remove, shall only be removed after due notice has been issued to such natives through the Native Commissioner of the district. Such notice shall comply with the terms of any agreement under which the said natives may be residing on the said land or any portion of it; and, in the absence of any agreement, sufficient time, not exceeding eighteen months, for the harvesting of crops already planted, or for the recovery of crops from lands to be prepared, shall be granted.

XI. Subject to the laws in force for the time being, all minerals, mineral oils and precious stones upon or under the said land belong to the British South Africa Company, which shall have the right by itself or its licencees or assigns at all times of entry on such portions of the said land as may be open to prospecting under any laws now or hereafter in force, for the purpose of inspection, survey, prospecting and mining.

XII. The Government or any body corporate or person duly authorised by the Government shall at all times have the power without compensation of making roads, telegraphs, railways and railway stations over and of taking materials for making or repairing roads, telegraphs and railways anywhere from any part of the said land which shall not have been improved by cultivation, irrigation or otherwise, and shall further have the power of making roads, telegraphs, railways and railway stations over and of taking materials for making or repairing roads, telegraphs or railways anywhere from any part of the said land which shall have been improved by cultivation, irrigation or otherwise, and of making aqueducts, dams and drains for the benefit of the public, on payment to the Purchaser of such sum of money in compensation as may be mutually agreed upon by the parties concerned, or failing such agreement, as may be settled by arbitration under the provisions of the "Lands and Arbitrations Clauses Act, 1882," of the Colony of the Cape of Good Hope.

XIII. The Purchaser shall keep in repair all beacons belonging to the said land.

XIV. The Government shall have the right of resuming possession of the said land or any portion thereof for any public purposes on paying or tendering to the Purchaser therefor, and for any improvements upon it, such sum of money in compensation as may be mutually agreed upon, or failing such agreement as may be settled by arbitration as aforesaid. Any compensation so paid shall be applied in reduction of the balance of the purchase price.

XV. Whenever under any grant or assignment from the British South Africa Company any person has the right to mine for any

mineral on or under the said land or any portion thereof (otherwise than under the "Mines and Minerals Ordinance, 1903," or any amendment or modification thereof for the time being in force), and the exclusive use of any portion of the said land is required for the purposes of such grant or assignment, the owner of such grant or assignment, if he cannot agree with the Purchaser, shall be entitled to such exclusive use on such terms as to the extent and situation of such land and the rental thereof, and compensation for improvements thereon (if any), as may be determined by arbitration as aforesaid.

XVI. All roads and thoroughfares existing over the said land shall remain free and uninterrupted unless the same be closed or altered by competent authority. Along any existing roads, or roads from time to time declared by the Governor-in-Council to be necessary for public requirements, persons travelling by vehicle, riding or travelling with stock or traction engines or otherwise, and persons having wagons for transport purposes, may outspan, travel, off-saddle or halt upon the said land, except where under cultivation or within two hundred yards of a dwelling house, and take water for such traction engines and depasture and water any animals used or driven by or accompanying them, for a period not exceeding twenty-four hours, excepting in cases of detention for a longer period by accident, stress of weather, swollen rivers or other unavoidable circumstances.

XVII. All indigenous timber standing or felled on the said land is reserved, except as is provided in Clause XVIII., and the Purchaser shall not interfere with the rights of holders of registered mining locations or of prospecting licences to cut and remove such timber under the supervision of the Mining Commissioner free of payment; provided that the Governor-in-Council may, in the exercise of his discretion and if satisfied that the interests of holders of registered mining locations or of prospecting licences will not thereby be prejudiced, grant permission to the Purchaser to cut and sell timber to persons other than holders of registered mining locations or of prospecting licences; such permission shall be subject to such terms and conditions as the Governor-in-Council may determine.

XVIII. The Purchaser shall have the right to cut on the said land, and use, such timber as he may require for his domestic purposes and farming operations thereon.

Thus done and executed at Salisbury on the  
day of 19 , in the presence of the sub-  
scribing witnesses.

.....  
Minister of Agriculture and Lands.

Witnesses:

1.....  
2.....

Given under my Hand and the Public Seal of the Colony of  
Southern Rhodesia, at Salisbury, this day of  
19 .

Seal.

.....  
Governor of Southern Rhodesia.

I do hereby accept the conditions stated in the above Agreement; and the several conditions on my part to be observed, I undertake to observe and perform.

Dated at \_\_\_\_\_ this \_\_\_\_\_ day of 19 \_\_\_\_\_.

Witnesses:

1.....  
2.....

The agreement printed above refers to land on gold belt, and differs from the non-gold belt form. For the non-gold belt title Clauses XVII. and XVIII. would be deleted, and the following clause substituted:—

Clause VII. The Purchaser shall have the right, during the term of this Agreement, to cut on the said land, and use, such timber as he may require for his domestic purposes and farming operations thereon, but he shall not sell or remove any wood therefrom without the express consent in writing of the Minister, and subject to such terms and conditions as he may determine.

#### EXPLANATORY NOTE.

The above is a copy of the new Agreement of Purchase which is available to settlers taking up ordinary grants of Crown land who do not at once wish to purchase the land outright.

The following statement in explanation of some clauses of the title, and the significance of certain changes made as compared with previous titles issued by the Land Settlement Department of the British South Africa Company, has been communicated to us.

In Clause I. the date of payment of the first instalment is the date of grant, of the second instalment six months thereafter; and the subsequent thirty-eight instalments are payable at intervals of six months. To take an example: if the purchase price of the land, including cost of survey, be £1,000, the first instalment will be £38 13s. 7d., payable on the date of grant, and the last instalment of a similar amount will be payable exactly 19½ years later.

Under the mortgage title recently issued, the settler was obliged on taking up land to pay the legal expenses of the bond, plus the survey fees, plus an instalment of one-twentieth of the purchase price. In the case of a farm valued at £1,000, the second instalment at the end of twelve months with interest would amount to £116 10s., diminishing year by year as interest lessened; but the first instalment without interest would be approximately similar. Under the old Permits of Occupation two years elapsed before the first payment was made; and in the case of a farm which was valued at £1,000, the first annual instalment was £60, plus one-fourth of first year's interest, the total being £75, this sum not including any part of the purchase price. This system of giving land for two years without payment has resulted in land being taken up for speculative purposes on which no

payment has ever been made, and is not considered to be in the interests of sound land settlement.

Part of the purchase price being paid on the date of grant, the settler acquires a different status from the permit holder, who was merely a tenant. Hence the change in name of the title. From the date of occupation the settler becomes in effect owner of his farm, and he will have in his land an asset valuable according to the proportion of the purchase price paid, and which will strengthen his credit accordingly. This asset, the consent of the Minister of Lands having been obtained, is alienable.

Clause XVII. gives the Purchaser the right, subject to the approval of the Governor-in-Council, to sell wood on gold belt title farms. This right would ordinarily be granted where the miner's rights were not prejudiced, as may sometimes be the case.

On non-gold belt titles the permit holder was forbidden to "sell or remove wood." This he may now do subject to the consent of the Minister of Lands, whose consent would usually be subject to the money earned being credited towards the purchase price of the land.

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## Railway Rates for Cotton.

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The following are the revised rates over the Beira and Mashonaland and Rhodesia Railways for locally grown cotton:—

1. Cotton seed for sowing purposes is charged at the following rates per ton, minimum 50 lbs.:—

| Miles<br>not<br>exceeding. | Beira-Salisbury<br>Section and<br>Lomagundi Branches. |     | Mafeking-Congo<br>Border, Salisbury<br>Sections and Branches. |
|----------------------------|-------------------------------------------------------|-----|---------------------------------------------------------------|
|                            | d.                                                    | d.  | d.                                                            |
| 10                         | 40                                                    |     | 40                                                            |
| 30                         | 91                                                    |     | 80                                                            |
| 50                         |                                                       | 127 |                                                               |
| 75                         |                                                       | 174 |                                                               |
| 100                        |                                                       | 210 |                                                               |
| 150                        |                                                       | 293 |                                                               |
| 200                        |                                                       | 360 |                                                               |
| 300                        |                                                       | 450 |                                                               |
| 400                        |                                                       | 480 |                                                               |
| 500                        |                                                       | 600 |                                                               |
| 600                        |                                                       | 720 |                                                               |

The following are the throughout rates per ton for cotton seed for sowing purposes from Umbogintwini to—

|                  | s.  | d. |
|------------------|-----|----|
| Bulawayo ... ..  | 82  | 1  |
| Gwelo ... ..     | 93  | 7  |
| Salisbury ... .. | 112 | 7  |
| Umtali ... ..    | 129 | 7  |

2. Seed cotton consigned to a ginnery, or for export *via* Beira or Mafeking, is charged at the following rates, minimum 50 lbs. (Rate 11):—

| Miles not exceeding | Per ton. |
|---------------------|----------|
|                     | d.       |
| 10                  | 40       |
| 30                  | 76       |
| 50                  | 106      |
| 75                  | 145      |
| 100                 | 175      |
| 150                 | 244      |
| 200                 | 300      |
| 300                 | 375      |
| 400                 | 400      |
| 500                 | 500      |
| 600                 | 600      |

3. Cotton lint for export *via* Beira or Mafeking is charged at the following rates, trucks to be loaded to full holding capacity:—

(Note.—At present no qualification as to the density of bales is being applied over these lines or the South African Railways.)

| Miles not exceeding | Per ton. |
|---------------------|----------|
|                     | d.       |
| 10                  | 40       |
| 30                  | 76       |
| 50                  | 106      |
| 75                  | 150      |

Over 75 miles, at 2d. per ton per mile.

The throughout rates from Salisbury to Beira, Delagoa Bay and Durban are as follows:—

|                                 | Per ton. |
|---------------------------------|----------|
|                                 | £ s. d.  |
| Salisbury to Beira ... ..       | 3 2 4    |
| Salisbury to Delagoa Bay ... .. | 8 8 6    |
| Salisbury to Durban ... ..      | 8 4 5    |

4. Oil cake for cattle feeding is charged at the following rates per ton, minimum 50 lbs.:—

| Miles<br>not<br>exceeding. | Beira-Salisbury<br>Section and<br>Lomagundi Branches. |     | Mafeking-Congo<br>Border, Salisbury<br>Sections and Branches. |
|----------------------------|-------------------------------------------------------|-----|---------------------------------------------------------------|
|                            | d.                                                    | d.  | d.                                                            |
| 10                         | 40                                                    |     | 40                                                            |
| 30                         | 91                                                    |     | 80                                                            |
| 50                         |                                                       | 127 |                                                               |
| 75                         |                                                       | 174 |                                                               |
| 100                        |                                                       | 210 |                                                               |
| 150                        |                                                       | 293 |                                                               |
| 200                        |                                                       | 360 |                                                               |
| 300                        |                                                       | 450 |                                                               |
| 400                        |                                                       | 480 |                                                               |
| 500                        |                                                       | 600 |                                                               |
| 600                        |                                                       | 720 |                                                               |

5. Cotton seed consigned to an oil factory (not for export) is charged at the following rates per ton:—

| Miles<br>not<br>exceeding. | Minimum<br>15<br>tons. | Smaller Quantities.                                   |                                                               |
|----------------------------|------------------------|-------------------------------------------------------|---------------------------------------------------------------|
|                            |                        | Beira-Salisbury<br>Section and<br>Lomagundi Branches. | Mafeking-Congo<br>Border, Salisbury<br>Sections and Branches. |
|                            |                        | d.                                                    | d.                                                            |
| 10                         | 40                     | 40                                                    | 40                                                            |
| 30                         | 76                     | 91                                                    | 80                                                            |
| 50                         | 106                    |                                                       | 127                                                           |
| 75                         | 145                    |                                                       | 174                                                           |
| 100                        | 175                    |                                                       | 210                                                           |
| 150                        | 244                    |                                                       | 293                                                           |
| 200                        | 300                    |                                                       | 360                                                           |
| 300                        | 375                    |                                                       | 450                                                           |
| 400                        | 400                    |                                                       | 480                                                           |
| 500                        | 500                    |                                                       | 600                                                           |
| 600                        | 600                    |                                                       | 720                                                           |

## Umvuma Show.

The second annual produce and poultry show of the Umvuma District Farmers and Stockowners' Association will be held on Saturday, 26th January next, at Umvuma. An attractive prize list has been drawn up, and every effort is being made to eclipse the success recorded at the inaugural event last January. Entries close on the 5th January with the Secretary, Mr. M. W. Graham, P.O., Umvuma.

# Southern Rhodesia Veterinary Report.

August, 1923.

## AFRICAN COAST FEVER.

No fresh outbreaks. The following mortality occurred at existing centres of infection in the Charter district: Hoffmania 1, Kopje Alleen 8, Onze Rust 32, Inhoek 3, Elminie 2, Swindon 13, Jackalsdraai 16. In the Melssetter district three head were destroyed on the farm Morgenson.

## CONTAGIOUS ABORTION OF CATTLE.

Four fresh centres of infection reported.

## TRYPANOSOMIASIS.

A heavy mortality occurred amongst cattle in the Ndanga East Reserve and was investigated. Examination of blood smears showed trypanosomiasis to be the cause.

## HORSE-SICKNESS.

The following mortality in horses was reported: Gwelo 3, Selukwe 1, Darwin 1.

## IMPORTATIONS.

From Union of South Africa: Bulls 14, heifers 6, horses 128, mules 36, donkeys 236, sheep 136, goats 503.

## EXPORTATIONS.

To Union of South Africa: Slaughter cattle 5,068, pigs 82. To Northern Rhodesia: Horses 5, mules 2, sheep 35, pigs 6. To Belgian Congo: Horses 6, goats 60. To Portuguese East Africa: Horses 10, mules 2, bulls 5.

September, 1923.

## AFRICAN COAST FEVER.

No fresh outbreaks. The following mortality occurred at existing centres of infection in the Charter district: Kopje Alleen 3, Onze Rust 1, Inhoek 3, Swindon 3, Jackalsdraai 9.

## CONTAGIOUS ABORTION OF CATTLE.

Thirteen fresh centres of infection reported.

### HORSE-SICKNESS.

On 8th September fourteen mules arrived in Bulawayo from Johannesburg, and between the 15th and 27th eleven of them died from horse-sickness. On 11th September ten horses arrived at Lydiate from the Orange Free State, and between the 15th and 29th six of them died from horse-sickness. It is difficult to suggest a reason for this gross mortality during the winter season. In both instances the deaths so early after arrival point to infection *en route*. In addition, two uninoculated horses died in the Hartley district.

### MYIASIS (SCREW WORM) OF CATTLE.

This complaint was prevalent in the Chibi and Nyamandhlovu districts.

### IMPORTATIONS.

From Great Britain: Bulls 4. From Union of South Africa: Bulls 91, heifers 27, horses 46, mules 25, donkeys 207, sheep and goats 2,062, pigs 49.

### EXPORTATIONS.

To Union of South Africa: Slaughter cattle 4,905, sheep and goats 185, pigs 215. To Belgian Congo: Sheep and goats 140. To Northern Rhodesia: Sheep 65. To Portuguese East Africa: Cows 37, calves 33, heifers 4, horse 1, sheep 75. To Nyasaland: Bulls 6, cows 4.

J. M. SINCLAIR,

Chief Veterinary Surgeon.

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## Agricultural Outlook.

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At the time of writing (20th November) the absence of rain is causing anxiety, and a speedy break in the weather is earnestly hoped for. The rainfall all over the Colony is below normal, but the shortfall is greatest in the northern and eastern districts. The lack of moisture is retarding cultural operations, inasmuch as the land in many instances is too hard to reduce to a proper state of tilth. The difficulty will be found even greater by that small section of less progressive farmers who still fail to realise the importance of autumn and early winter ploughing. The position of maize growers on the high veld will become acute if the rains hold off much longer. Where the season renders the successful planting of maize uncertain, farmers



would be well advised to consider the planting of an increased acreage of sunflower. This crop is more resistant to drought than maize, and there seems every prospect of a good demand for seed. Whilst referring to oil seeds, it may be mentioned that owing to the extremely heavy rainfall of last season the ground nut crop was a very short one, and every effort should be made to produce this commodity in sufficient quantity to initiate a regular export trade. Tobacco growers are not yet seriously perturbed at the continuance of the dry spell, but for those who contemplate the planting of cotton the time is getting short. It is greatly to be hoped, in view of the large number of farmers concerned, that the season will not prove to be unfavourable. An article on the growing of cotton appeared in the last issue of this *Journal*, and was reprinted as Bulletin No. 466.

Grass fires have been very prevalent during the past two months, and large tracts of country have been burnt out. It is surprising that quite a number of farmers still fail to adopt the rudimentary precaution of providing boundary and sub-divisional fire guards. There is reason to believe that land owners still make little or no attempt to avail themselves of the assistance of the Native Department in burning fire guards.

The statistics of maize and the crops grown in Southern Rhodesia during the season 1922-23 will be published in our next issue. South African white flat maize continues to realise a higher price on the English market than Argentine yellow, and a recent cabled quotation reached 38s. a quarter.

During the past two seasons experiments with barley on an extensive scale have been carried out by the Department of Agriculture with the very kind help of the South African Breweries, Ltd., in conjunction with a large number of farmers. In this connection it will be interesting to many farmers to learn that beer is now actually being made in Salisbury from Rhodesian-grown barley. The first crop to be so used was that grown by the British South Africa Company at the Premier Estate, Umtali, where on irrigated land a yield of sixteen bags per acre was realised. There is yet room for a considerable increase in the production of barley for local consumption before all our needs are satisfied.

Owing to the sparsity of the pasturage and the intense heat cattle are rapidly falling off in condition, and it is feared that unless copious rains fall soon considerable mortality from poverty will occur. Prime stock are fetching good prices locally and are in keen demand at Johannesburg. Those farmers who have fed farm produce to suitable beasts have been repaid for the outlay. The drought in the Union and Rhodesia has necessitated the importation of large quantities of butter from overseas. The price of butter fat is abnormally high, and most dairy farmers are adopting the wise course of sending their surplus cream to the creamery in preference to making cheese, of which there is likely to be a distinct shortage in the near future. As soon as the rains set in and the price of butter fat drops, cheese makers would be well advised to begin operations, as there is every likelihood of the price of cheese being firm throughout the coming season.

## Farming Calendar.

### December.

#### BEE-KEEPING.

Honey in good quantities will still be coming in, as the welcome rains will be beneficial to veld blooms. Continue to give room by extracting honey from shallow frames, then return these to be refilled. Extracted honey should be drawn from the machine into the honey ripener, into which it should be strained through several thicknesses of butter muslin, remaining there, to allow surplus water to evaporate, for five days, then draw off from the tap into clear white glass bottles. All bottles must be cleansed thoroughly. See that ventilation is ample on hot days.

#### CITRUS FRUITS.

Citrus trees can be planted out at any time between October and the end of January. The best time is the end of October or early November, when the ground is warm and trees have hardened up their first growth of season, *i.e.*, spring growth, and are in fit condition to commence second growth, which they will do if transplanted properly at that time—end of October. Citrus trees should not be planted later than the end of January, as the growth they put on after planting later than this is very liable to be still sappy at the approach of winter, and consequently more sensible to the effect of cold. The young trees require to be well watered after planting. The soil around them should never be allowed to be really dry, but, on the other hand, it must not be kept in a state of sogginess. Immediately after planting protect the stems of the young trees from the sun by whitewashing or covering up with grass. Cut the tree down so as to leave a stem of about 2 ft. 6 ins. or 3 ft. long, and form the head of the future tree in the top 8 ins. or 1 ft., according to the best position of the shoots, not more than three or four in number. All other growths to be suppressed whenever they appear. Keep the soil nice and loose by digging, forking or hoeing round the young trees. It will then not be necessary to water them so frequently. The orchard should by this time have been thoroughly ploughed, and any cover crop sown already be up and growing. Don't forget, before the wet season, the first ploughing should be up and down the steepest gradient of the orchard, and be followed immediately after harrowing by cross-ploughing across the hill. This is to obviate as much as possible erosion of the soil during the coming heavy rains. Remember that, if a long spell of dry weather occurs during the so-called wet season, your bearing orange trees will probably require an application of water, otherwise the crop of fruit may receive a check from which it will never properly recover.

#### CROPS.

This is the busiest planting month of the farm year, during which most crops should be sown. Main crop maize planting is usually commenced in November and continued through December, but should be finished if possible at latest by Christmas. Light harrowing with the Hallick weeder or light tooth harrow soon after germination of the maize and until the plants are 6 to 10 inches high is beneficial, most in keeping down weeds and main-

taining a soil mulch. This harrowing is better done during the heat of the day, when plants are less liable to break off. Other crops which will be sown during the month are ground nuts, velvet beans, sunflower, cowpeas, pumpkins, mangold, majorda melons, linseed, hibiscus and Sunn hemp for fibre or seed.

### DAIRYING.

The summer now being far advanced, attention should be given to the percentage of fat in cream, as the cream should contain a higher percentage in the summer than in the winter. Adjust the cream screw of your separator so that you obtain cream testing from 40 to 50 per cent. butter fat. The reason for this is that a heavy bodied cream carries better than one testing only 30 per cent., and will remain sweeter during a long journey. Most separators are adjusted to skim cream testing about 45 per cent. butter fat, and if an excessively high testing cream is produced the efficiency of the separator will be impaired and a loss will be sustained in the separated milk. So do not attempt to separate cream of a higher test than 50 per cent. Cheese making is now in full swing, and it should be remembered that good cheese cannot be made from tainted or acid milk. Clean milk is essential for cheese making, and it can only be obtained by the provision of a milking shed with an impervious floor. Milking in a muddy kraal will result in a gassy bitter cheese being produced. During the wet months the provision of a dry, warm shelter for calves is essential. Exposure to inclement conditions of weather and retention of the calves in a filthy, muddy kraal will result most probably in an epidemic of white scour and ophthalmia. Commonsense treatment and commonsense housing are necessary if dairy calves are to be successfully reared.

During this month provision for winter feed should be made by sowing maize for silage, pumpkins, sweet potatoes, cattle radish, mangels, sunflowers both for seed and silage, ground nuts, teff grass, Boer manna, Sudan grass, beans and cowpeas.

### ENTOMOLOGICAL.

**Maize.**—Plant during first half of this month to avoid stalk borers. See "Maize Stalk Borer," *Agricultural Journal*, December, 1917. Distribute poisoned bait shortly before or immediately after planting on red soils to destroy various pests, including surface beetles, snout beetles, etc., which may affect the stand. See "Maize on Red Soils," *Agricultural Journal*, April, 1919. Cutworms and Maize Beetle (*Heteronychus*) may be in evidence. See "Cutworms," *Agricultural Journal*, August, 1918, and the "Maize Beetle," *Agricultural Journal*, February, 1918.

**Tobacco.**—The newly planted crop is subject to the attack of cutworms, surface beetles, stem borers, leaf miners, "wireworms," grasshoppers, large crickets, etc. A good deal of protection may be obtained by dipping the tops of the transplants as far as the roots in arsenate of lead 1 lb. to 15 gallons of water. See *Agricultural Journal*, December, 1919, and February, 1920.

**Potato.**—Ladybirds may be injurious to the foliage. See "Two Ladybirds injurious to Potato Plants," *Agricultural Journal*, October, 1913. On sandy soils blue blister beetles may be troublesome. An immediate spraying with arsenate of lead 1 lb. to 12 gallons water should give relief.

**Cabbage, Turnip, etc.**—Webworm and diamond back moths are still the main pests. See "Cabbage Webworm," *Agricultural Journal*, February, 1914. Dusting with Paris green and lime should give protection against both pests.

**Bean.**—Stem maggot may be serious in December, especially if previous crops have been grown for French beans in gardens. See "Bean Stem Maggot," *Agricultural Journal*, April, 1913.

**Melon, Marrow, etc.**—Leaf-eating beetles frequently destroy the very small plants entirely. Spray with an arsenical and sugar wash or dust with Paris green 1 lb., lime 20 lbs.

*Deciduous Trees.*—Chafer beetles, fruit beetles are commonly very troublesome. See "Chafer Beetles," *Agricultural Journal*, December, 1914.

*Fig.*—Collect and destroy all fruit infested with fig weevil, and any wild figs near to the orchard.

*Mosquitoes, House Flies, Stable Flies.*—Destroy all breeding places round homestead. Poison or trap adults. See *Agricultural Journal*, June, 1915, and December, 1916.

#### FLOWER GARDEN.

This month is generally showery, and constant stirring of the soil is, therefore, necessary to keep it loose. Seeds of perennials and annuals for February blooms may be sown. Transplanting should be done in the evening or on a cloudy day. Carnations should be kept free from dead wood, and climbers attended to.

#### VEGETABLE GARDEN.

All vegetable seeds may be planted. All advanced plants should be constantly cultivated. Potatoes should be ridged, and peas, beans and tomatoes staked. This is a good month for planting the main crop of potatoes.

#### FORESTRY.

Give the ground the final harrowing, and if the season is a normal one, planting out should commence. This is the ideal month for planting out in a normal season, as the young trees have the benefit of all the summer rains, and become well established before the dry winter months arrive. Plant on dull, rainy days, or failing such days, late in the afternoons.

#### POULTRY.

Some of the birds will now be moulting. As they commence to do so, it is advisable to put them into a separate pen and treat them in such a manner as to get them through their moult as quickly as possible and on the lay again. They should be given additional food of the nature of linseed, monkey nuts, sunflower seed and leaves, green food of the Brassica tribe, i.e., cabbage, kale, cauliflower leaves, etc., and a little flowers of sulphur (one teaspoonful to 1 lb. of dry mash) daily. The above assists the growth of the feathers. The birds that moult late are usually the best layers, and these should be marked.

During the wet season the birds must be kept dry, as also the houses, otherwise the egg yield will drop and the birds themselves fall off in health.

No young cockerels or cocks should be running with any of the birds now. The hatching season does not begin again till April, and all eggs should be unfertile now.

Turkey hatching should have concluded six weeks to two months ago, as young turkeys less than this age will, if they become wet, either die or become stunted. Hatching of turkeys can commence again when the wet season is finished.

Ducklings can be hatched all the year round, but there are two important points to be noted, viz., they must sleep on absolutely dry bedding and must be kept out of the hot sun. Those destined for killing should be kept in a small run, allowed very little exercise, fed all they will eat, in order to be ready for the table in from eight to ten weeks. Ducks are profitable only when treated in this manner, and their owner can get contracts for so many per week.

#### STOCK.

*Cattle.*—The veld in most districts is now good, and little trouble in respect of grazing is likely to be experienced. Ranching cattle should not require any attention beyond dipping, but any stock that are in weak con-

dition will be the better for a little hay or a pound or two of maize at night until they have regained strength. The bulls should be returned to the herd either at the end of the month or in January, and it should be remembered that the better they are conditioned and fitted for their work the more hope there is of a good crop of calves. For this reason also every effort should be made to have all the female stock in strong condition. Dairymen will find that as the grass becomes lush and rank a supply of sweet veld hay, teff hay or, say, three pounds of crushed maize given in the sheds at night will enhance both the quality and quantity of the milk. This will be found to be the case more particularly in districts of heavy rainfall. Milch cows should be protected as much as possible from cold rains and hot sun. Yarding all night in a clean kraal provided with a simple lean-to shed well bedded up will be found to be very beneficial in seasons of protracted rainfall. The calf pen should be kept clean, dry and sweet, and young calves will be better kept in during very hot or very wet weather. Dipping should be regularly attended to.

*Sheep.*—Graze on the higher lands, keeping the kraals clean, dry and airy, and watch for ticks.

### TOBACCO.

Continue preparation of land. The best results are obtained by transplanting on freshly prepared soil. Transplanting should be pushed as fast as transplants and climatic conditions will allow. As soon as plants begin to grow, go over the field and fill in all missing hills with strong selected plants, and then apply fertilisers to hasten growth and ensure early maturity. Cultivation should be commenced as soon as the plants start growing, especially on sandy soils. The crust caused by heavy rains should be pulverised through cultivation as soon as the surface soil is dry enough for tillage; this gives the young plants the benefit of the moisture stored in the soil. Do not neglect the late sown seed beds. Make every effort to finish transplanting before the end of the month, so that the crop will be harvested before dry, cool weather begins.

### VETERINARY.

Occasional cases of horsesickness may occur during this month. With the great increase in ticks, due to the heat and moisture, cases of redwater and gallsickness may be expected, more especially amongst Colonial stock imported since the last rainy season. The cool weather which frequently follows the early rains is an excellent time for castrating calves and other animals.

### WEATHER.

In Mashonaland usually six inches of rain fall this month, and in Matabeleland five inches, but considerable variations occur. Less rain usually falls at this time in extreme southern parts of the country. Very heavy downpours may be looked for, and it is well to be provided by drains and ditches against the effects of heavy rain storms. A dry spell about Christmas time is a very frequent, though not invariable, event in Rhodesia. This partial drought may last only a fortnight or may extend to six weeks, in the latter event often causing some anxiety regarding young crops, especially those not yet through the ground. The best means of meeting this condition of the weather is by frequent surface cultivation by harrow or horse hoe, to preserve a loose soil mulch on the surface and prevent losses of soil moisture by evaporation.

## January.

### BEE-KEEPING.

Where it is desirous, artificial swarms can now be made, so also can nuclei be formed from proved best working strains. All the above must be

stimulated with food. In the cooler districts it will be necessary to contract the entrances and close down for winter.

### CITRUS FRUITS.

(See under December notes.)

### CROPS.

Sowing of maize and beans for ensilage and Sunn hemp or beans for green manuring may be continued up to the middle of the month. Hay crops such as teff grass, manna, Sudan grass and summer oats should go in during the first week of this month. Napier fodder, Kikuyu and other grasses may be planted out, and catch crops of teff and buckwheat can be put in up to the end of the month.

### DAIRYING.

(See December.)

### ENTOMOLOGICAL.

*Maize*.—This crop is subject to the attack of stalk borer, maize beetle (*Heteronychus*), snout beetles, grasshoppers, crickets, etc. See *Agricultural Journal*, April, 1919. Maize planted after the first of the year is extremely liable to almost complete failure as a crop from the second brood of the stalk borer. See *Agricultural Journal*, December, 1917. This is of less importance in regard to ensilage.

*Tobacco*.—Most of the pests of this crop are active during January, e.g., stem borer, leaf miner, "wireworms," surface beetles, large crickets, grasshoppers, etc. See *Agricultural Journal*, December, 1919, February, 1920.

*Potato*.—Certain ladybirds are apt to defoliate the young potato plants of the main crop, especially on farms where early potatoes are also grown. See *Agricultural Journal*, October, 1913. Blue blister beetles are apt to be injurious on sandy soils, and may be checked by spraying with arsenate of lead 1 lb. to 12 gallons of water. Spraying should be commenced for early blight. See *Agricultural Journal*, August, 1913.

*Cabbage Family*.—Plants of this family are subject to the attacks of webworm and sawfly in January. See *Agricultural Journal*, February, 1914, April, 1910, April, 1917, June, 1918.

*Beans and Cowpeas*.—These suffer chiefly from stem maggot. See *Agricultural Journal*, April, 1913. On small plots aphids may be checked by spraying with tobacco wash or paraffin emulsion.

*Melon Family*.—The chief pests in January are leaf-eating beetles. Spray with an arsenical wash or cover young plants.

*Citrus Trees*.—The fruit is subject to the attack of citrus codling. Collect and destroy the infested fruits. For this and other citrus pests see *Agricultural Journal*, February, 1916.

*Deciduous Fruits*.—These are all subject to the attack of fruit-eating beetles. See "Chafer Beetles," *Agricultural Journal*, December, 1914. Fruit moths are injurious during this month, the only preventive measure being to net the trees. For fruit fly remedies, see *Agricultural Journal*, August, 1911.

*Fig*.—The adult beetles of the fig borer are to be found on the young shoots. They should be destroyed. The grubs in the stems may be killed with a little carbon di-sulphide.

*Mosquitoes, House Flies, Stable Flies*.—See under previous month.

### FLOWER GARDEN.

This month requires all one's energy in the flower garden. Annuals may still be sown for late flowering before the season is over. Planting out

should be done as early as the weather permits, and advantage taken of a dull day after a shower for this work. If care be exercised much smaller plants may be put out than would at first be thought advisable, as with attention these will make stronger plants than larger ones, which are more likely to receive a check. The soil requires constant stirring, owing to the packing caused by the rains and for the eradication of weeds, which are now very troublesome. All plants should be kept free of dead and decaying matter.

### VEGETABLE GARDEN.

Turnips, carrots, cabbage, lettuce, etc., may be sown for carrying on during the winter months. Potatoes may be planted this month for keeping through the winter. Weeding and cultivating between the rows should be continually carried on.

### FORESTRY.

If the rains are seasonable, plant out evergreen trees, such as gums, cypress, pines, etc. Fill in all blanks as soon as they are noticed, and do not leave them until the following season. Planting should be done on a wet day, or failing that, on a dull day, or late in the afternoons.

### POULTRY.

Grading and selection of the breeding birds should now commence. Only the very best layers and strongest and most vigorous birds should be chosen. When selected, it is advisable to let them run on free range before confining them to the breeding pens next month.

This is the month, for those intending to start poultry keeping, to commence getting the houses, runs, etc., in order, and everything should be ready for the breeding stock by the middle of February. Leave nothing undone, and never have recourse to make-shifts, which are fatal to success. Commence to keep the eggs for hatching at the end of the third week in February, and keep no eggs longer than ten days. They must be kept in a cool, even temperature, and out of draughts. Place them on their small ends and turn every alternate day. A bad hatch is often the result of keeping the eggs under wrong conditions. There are also many other causes, *e.g.*, weak stock, stock that are too fat, lack of green food, lack of scratching exercise, uneven temperature in the incubator room, lack of fresh air, vibration, lack of sufficient moisture, etc.

All last season's pullets, if hatched at the right time and reared well, should now be laying well. Don't make any sudden change in the quarters, in the arrangements of the interior fittings of the houses or in the food, etc., otherwise the birds will stop laying and go into a partial moult. Kill any weak chicks at once; they will never make good, profitable birds, and are not worth the time and trouble of rearing. Never help a chick out of the shell; if it is not strong enough to get out of itself, it is no good. Give the chicks no food for the first thirty-six hours after hatching. Keep them absolutely quiet, and let them sleep. Take time by the forelock and have the incubators working and in good order several days before the eggs are ready to put in.

If broody hens are to be used for hatching, commence to lay in a stock at once. The Mashona fowl is excellent for this purpose, but as soon as they are purchased, dip them, isolate them for a fortnight, and dip them again. There will then be no likelihood of them bringing in disease or insects. As soon as each bird becomes broody put her on two or three china eggs; they will then be ready to take the settings of eggs as they are produced by the breeding birds.

If birds in the breeding pens show signs of broodiness, stop them at once. You want eggs from them for hatching; they must not waste time in sitting.

## STOCK.

*Cattle.*—The recommendations for December apply equally to this month. Bulls should be returned to the herd during the month if a September or October calving season is desired.

*Sheep.*—Continue as recommended for December. If heavy rains are experienced a daily ration of half a pound of maize per ewe will keep them in condition and will often prevent much trouble arising from poverty and anæmia. Those who favour autumn lambs must put the ram again with the flock in February, and should therefore now take steps (if necessary) by supplying a little extra feed as above recommended to fit the ewes for mating. A little forethought of this kind will tend to increase the stamina of the lambs and to bring the ewes in season more or less together, so that a protracted lambing season is avoided.

## TOBACCO.

Cultivation should be systematically continued, and no foreign vegetation allowed in the tobacco field, as weeds and grass induce insect attacks. All backward plants should be given special attention, and an additional application of fertiliser to hasten growth so that the plants ripen as uniformly as possible. Curing barns should be placed in proper condition on rainy days, and all tobacco appliances should be placed in proper order for the rush of work during the curing season. Early planted tobacco may be ready for topping during the latter part of the month, and the common mistake of topping too high should be avoided. Go over the field carefully and select typical, uniform plants for producing seed for next season's crop.

## VETERINARY.

Horsesickness may now be expected, especially in districts where early heavy rains have occurred. Blue tongue in sheep will also be prevalent.

## WEATHER.

Heavy rain is to be looked for, and during this month we may normally expect nine to twelve inches on the eastern border, seven-and-a-half in the north, and less as one travels westwards or southwards. At this time of year the rainfall tends to be heavier in the eastern than in the western portions of the Territory, whilst prolonged steady rains take the place of the thunder showers which marked the earlier part of the wet season. The growing period is at its height, and high temperatures are registered.



## Southern Rhodesia Weather Bureau.

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SEPTEMBER AND OCTOBER, 1923.

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**Pressure.**—During the month of September the mean barometric pressure was about normal over the whole country. The maximum range of barometric pressure varied from 0.23 in. at Bulawayo and Umtali to 0.16 in. at Salisbury and Gwelo. A high pressure area was present from the 5th to the 14th, the maximum high on the 11th being 0.11 in. above normal at Bulawayo and 0.06 in. above normal at Salisbury. A low pressure area was present from the 15th to the 24th, and normal pressure prevailed during the remainder of the month. The minimum low on the 19th was 0.12 in. below normal at Bulawayo and 0.10 in. below normal at Salisbury.

During the month of October the mean barometric pressure was about 0.03 in. above normal over the whole country. The maximum range of barometric pressure varied from 0.43 in. at Umtali to 0.32 in. at Salisbury. This is an abnormally large range for this month.

An exceedingly high pressure area advanced over the country from the south on the 5th and succeeded a low pressure which was prevalent on the 4th, the range during the 24 hours amounting to 0.30 in. at Salisbury. The maximum high on the 5th was 0.21 in. above normal at Salisbury and is the absolute maximum pressure recorded at this station during the month of October, and is also the highest pressure recorded during the current year. The high pressure area prevailed in modified form over the whole country till the 20th. Low pressure areas were present on the 2nd to the 3rd and 21st to the 27th. The maximum low occurred on the 26th, and was 0.12 in. below normal at Salisbury.

**Temperature.**—During the month of September the mean temperature was above normal over the whole country, and varied from 1.8 degrees F. above normal at Umtali to 0.5 degree F. above normal at Salisbury. The mean daily temperatures varied from 3.6 degrees F. above normal at Gwelo to 0.7 degree F. above normal at Umtali, whilst the mean night temperatures varied from 2.8 degrees F. above normal at Umtali to 0.2 degree F. below normal at Gwelo. During the month of October the mean temperature was above normal over the whole country, and varied from 3.3 degrees F. above normal at Gwelo to 0.2 degree F. above normal at Umtali. The mean daily temperatures varied from 5.4 degrees F. above normal at Gwelo to 0.6 degree F. below normal at Umtali, whilst the mean night temperatures varied

from 3.1 degrees F. below normal at Salisbury to 1.2 degrees F. at Umtali. During the period 6th to the 10th low minimum temperatures were recorded generally, and light frosts were experienced in the higher portions of the country. This is abnormally late for frosts in this Colony.

**Rainfall.**—During September only very light scattered showers occurred towards the latter end of the month. During October the mean rainfall over the whole country was 0.8 in. below normal, and the deficiency was distributed over the various zones as under:—

|                                      | Mean rainfall,<br>October.<br>Inches. | Mean normal<br>rainfall, October.<br>Inches. |
|--------------------------------------|---------------------------------------|----------------------------------------------|
| Zone A (western Matabeleland) ... .. | 0.02                                  | 0.81                                         |
| Zone B (south-eastern Matabeleland)  | 0.01                                  | 0.88                                         |
| Zone C (western Mashonaland) ... ..  | 0.12                                  | 1.02                                         |
| Zone D (north-eastern Mashonaland)   | 0.44                                  | 0.79                                         |
| Zone E (south-eastern Mashonaland)   | 0.12                                  | 1.15                                         |
| Zone F (eastern border) ... ..       | 0.36                                  | 1.89                                         |

Light showers were fairly general throughout the country on the 4th; very scattered showers were reported on the 20th, and fairly general showers were reported during the period 25th to the 30th.

## RAINFALL.

| STATION.              | 1923. |      | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|-----------------------|-------|------|-------------------------------|--------------------------------------------|
|                       | Sept. | Oct. |                               |                                            |
| ZONE A.:              |       |      |                               |                                            |
| Bubi—                 |       |      |                               |                                            |
| Glenmartin Estate ... | ...   | ...  | ...                           | n.s.                                       |
| Imbesu Kraal ...      | 0.06  | —    | 0.21                          | 1.13                                       |
| Inyati ...            | —     | 0.44 | 0.44                          | 1.12                                       |
| Maria Farm ...        | ...   | ...  | 0.02                          | n.s.                                       |
| Maxim Hill ...        | ...   | ...  | ...                           | 0.95                                       |
| Shangani Estate ...   | ...   | —    | ...                           | 1.07                                       |
| Bulalima—             |       |      |                               |                                            |
| Kalaka ...            | 0.05  | ...  | 0.05                          | 1.22                                       |
| Riverbank ...         | 0.10  | 0.04 | 0.14                          | 1.09                                       |
| Solusi Mission ...    | ...   | ...  | ...                           | 1.03                                       |
| Bulawayo—             |       |      |                               |                                            |
| Fairview Farm ...     | ...   | ...  | ...                           | 1.10                                       |
| Keendale ...          | 0.01  | —    | 0.08                          | 0.98                                       |
| Lower Rangemore ...   | ...   | ...  | 0.05                          | 1.11                                       |
| Observatory ...       | 0.01  | ...  | 0.01                          | 1.13                                       |
| Umgusa ...            | ...   | ...  | ...                           | 1.10                                       |
| Gwelo—                |       |      |                               |                                            |
| Dawn ...              | ...   | ...  | ...                           | 1.24                                       |
| Gwelo Gaol ...        | ...   | 0.05 | 0.05                          | 0.97                                       |
| Riversdale Estate ... | ...   | ...  | ...                           | 1.03                                       |
| Somerset Estate ...   | —     | —    | ...                           | 0.91                                       |
| Insize—               |       |      |                               |                                            |
| Orangedale ...        | ...   | ...  | ...                           | 1.15                                       |
| Thornville ...        | —     | ...  | ...                           | 1.23                                       |
| Nyamandhlovu—         |       |      |                               |                                            |
| Gwaai Reserve ...     | 0.05  | —    | 0.05                          | n.s.                                       |
| Impondeni ...         | 0.03  | 0.25 | 0.36                          | ...                                        |
| Naseby ...            | 0.09  | 0.08 | 0.17                          | 1.12                                       |
| Paddy's Valley ...    | ...   | ...  | ...                           | n.s.                                       |
| Wankie—               |       |      |                               |                                            |
| Lynwood ...           | ...   | ...  | ...                           | 1.33                                       |
| Waterford ...         | ...   | ...  | ...                           | n.s.                                       |
| Wankie Hospital ...   | ...   | ...  | ...                           | 0.98                                       |
| Sebungwe—             |       |      |                               |                                            |
| Gokwe ...             | ...   | —    | ...                           | 0.97                                       |
| ZONE B.:              |       |      |                               |                                            |
| Belingwe—             |       |      |                               |                                            |
| Belingwe Ranch ...    | ...   | ...  | 0.03                          | n.s.                                       |
| Bickwell ...          | ...   | ...  | ...                           | 1.00                                       |
| Bubje Ranch ...       | ...   | ...  | ...                           | n.s.                                       |
| Bulalima—             |       |      |                               |                                            |
| Edwinton ...          | 0.07  | ...  | 0.07                          | 1.45                                       |
| Garth ...             | 0.03  | 0.02 | 0.05                          | 1.20                                       |
| Maholi ...            | ...   | ...  | ...                           | 1.78                                       |
| Retreat ...           | 0.06  | 0.06 | 0.12                          | 0.98                                       |
| Sandown ...           | 0.07  | ...  | 0.07                          | n.s.                                       |
| Tjompanie ...         | 0.05  | 0.02 | 0.07                          | 1.13                                       |

## RAINFALL—(Continued).

| STATION.                     | 1923. |      | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|------------------------------|-------|------|-------------------------------|--------------------------------------------|
|                              | Sept. | Oct. |                               |                                            |
| ZONE B.—(Continued)          |       |      |                               |                                            |
| Gwanda—                      |       |      |                               |                                            |
| Gwanda Gaol ... ..           | —     | —    | ...                           | 0.96                                       |
| Limpopo ... ..               | 0.01  | —    | 0.01                          | n.s.                                       |
| Tuli ... ..                  | ...   | ...  | ...                           | 1.01                                       |
| Insiza—                      |       |      |                               |                                            |
| Albany ... ..                | —     | ...  | 0.07                          | 0.98                                       |
| Filabusi ... ..              | —     | —    | ...                           | 1.00                                       |
| Fort Rixon ... ..            | ...   | ...  | ...                           | 1.02                                       |
| Infiningwe ... ..            | ...   | ...  | 0.16                          | 1.18                                       |
| Lancaster ... ..             | —     | ...  | ...                           | n.s.                                       |
| Matobo—                      |       |      |                               |                                            |
| Holly's Hope ... ..          | ...   | ...  | ...                           | 1.05                                       |
| Mtshabezi Mission ... ..     | 0.01  | —    | 0.01                          | 1.06                                       |
| Matopo Mission ... ..        | 0.09  | ...  | 0.09                          | 1.00                                       |
| Rhodes Matopo Park ... ..    | 0.07  | ...  | 0.07                          | 1.09                                       |
| Umfula ... ..                | ...   | ...  | 0.01                          | n.s.                                       |
| Wenlock Ranch ... ..         | ...   | —    | ...                           | n.s.                                       |
| Umzingwane—                  |       |      |                               |                                            |
| Essexvale ... ..             | 0.02  | 0.04 | 0.13                          | 1.13                                       |
| Kodhwayo ... ..              | —     | ...  | 0.31                          | n.s.                                       |
| ZONE C. :                    |       |      |                               |                                            |
| Charter—                     |       |      |                               |                                            |
| Bushy Park ... ..            | —     | ...  | ...                           | 1.35                                       |
| Enkeldoorn ... ..            | ...   | 0.06 | 0.06                          | 1.49                                       |
| Marshbrook ... ..            | —     | —    | 0.15                          | 1.50                                       |
| Range ... ..                 | 0.05  | 0.04 | 0.19                          | 1.59                                       |
| Umnati ... ..                | ...   | 0.15 | 0.18                          | 1.19                                       |
| Vrede ... ..                 | ...   | ...  | ...                           | 1.47                                       |
| Chilimanzi—                  |       |      |                               |                                            |
| Allanberry ... ..            | 0.06  | 0.04 | 0.43                          | 1.23                                       |
| Central Estates ... ..       | ...   | —    | 0.06                          | 1.37                                       |
| Gwelo—                       |       |      |                               |                                            |
| Cross Roads ... ..           | —     | —    | ...                           | 0.94                                       |
| East Clare Ranch ... ..      | ...   | ...  | 0.05                          | n.s.                                       |
| Globe and Phenix Mine ... .. | —     | —    | 0.12                          | 1.07                                       |
| Indiva ... ..                | —     | ...  | ...                           | n.s.                                       |
| Lyndene ... ..               | ...   | 0.06 | 0.06                          | n.s.                                       |
| Rhodesdale Ranch ... ..      | —     | —    | ...                           | 0.97                                       |
| Hartley—                     |       |      |                               |                                            |
| Ardgowan ... ..              | ...   | 0.93 | 0.93                          | 1.48                                       |
| Balwearie ... ..             | ...   | 0.11 | 0.11                          | n.s.                                       |
| Beatrice... ..               | —     | 0.16 | 0.20                          | n.s.                                       |
| Carnock ... ..               | —     | 0.38 | 0.83                          | 1.60                                       |
| Cromdale ... ..              | —     | 0.52 | 0.52                          | n.s.                                       |
| Elvington ... ..             | —     | 0.12 | 0.61                          | 1.60                                       |
| Gatooma ... ..               | ...   | 0.42 | 0.42                          | 1.60                                       |
| Gowerlands ... ..            | —     | 0.74 | 0.74                          | 1.54                                       |
| Hallingbury ... ..           | —     | 0.05 | 0.05                          | 1.44                                       |
| Hartley Gaol ... ..          | ...   | 0.14 | 0.14                          | 1.65                                       |
| Hopewell ... ..              | —     | 0.11 | 0.11                          | 1.31                                       |

## RAINFALL—(Continued).

| STATION.                     | 1923. |      | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|------------------------------|-------|------|-------------------------------|--------------------------------------------|
|                              | Sept. | Oct. |                               |                                            |
| ZONE C.—(Continued)          |       |      |                               |                                            |
| Hartley (Continued)—         |       |      |                               |                                            |
| Jenkinson                    | ...   | ...  | ...                           | 1.52                                       |
| Philiphaugh                  | ...   | 1.04 | 1.14                          | 1.70                                       |
| Ranwick                      | ...   | ...  | ...                           | 1.44                                       |
| Spitzkop                     | ...   | ...  | ...                           | 1.47                                       |
| Lomagundi—                   |       |      |                               |                                            |
| Argyle                       | ...   | ...  | ...                           | 1.69                                       |
| Baguta                       | ...   | ...  | ...                           | 1.51                                       |
| Citrus Estate                | ...   | 0.36 | 0.36                          | 1.56                                       |
| Darwendale                   | ...   | ...  | ...                           | 1.59                                       |
| Dingley Dell                 | ...   | ...  | ...                           | n.s.                                       |
| Feira                        | ...   | ...  | ...                           | n.s.                                       |
| Freda                        | ...   | ...  | ...                           | n.s.                                       |
| Gambuli                      | ...   | ...  | 0.03                          | 1.93                                       |
| Gungurubee                   | ...   | ...  | ...                           | n.s.                                       |
| Impingi                      | ...   | ...  | ...                           | n.s.                                       |
| Mafoota                      | 0.30  | 0.45 | 1.14                          | n.s.                                       |
| Maningwa                     | 0.52  | 0.95 | 1.61                          | 1.81                                       |
| Mica Field                   | ...   | ...  | ...                           | n.s.                                       |
| Mpandegutu                   | ...   | 1.77 | 1.77                          | n.s.                                       |
| Mukwe River Ranch            | ...   | ...  | 0.50                          | 1.60                                       |
| Nyapi                        | ...   | 0.30 | 0.51                          | n.s.                                       |
| Nyaroro                      | ...   | ...  | ...                           | n.s.                                       |
| Nyati                        | ...   | ...  | ...                           | n.s.                                       |
| Palm Tree Farm               | 0.10  | 0.18 | 0.73                          | 1.66                                       |
| Richmond                     | ...   | 0.63 | 1.26                          | n.s.                                       |
| Romsey                       | ...   | ...  | 0.06                          | n.s.                                       |
| Sangwe                       | ...   | ...  | ...                           | n.s.                                       |
| Silater Estate               | ...   | 0.54 | 0.72                          | n.s.                                       |
| Sinoia                       | ...   | 0.50 | 0.52                          | 1.60                                       |
| Sipolilo                     | ...   | ...  | 0.37                          | 1.61                                       |
| Talfourd                     | ...   | ...  | 0.51                          | 1.76                                       |
| Umboe                        | ...   | ...  | ...                           | n.s.                                       |
| Umvukwe Ranch                | ...   | 0.25 | 0.45                          | 1.61                                       |
| Woodleigh                    | 0.27  | 1.25 | 1.72                          | n.s.                                       |
| Salisbury—                   |       |      |                               |                                            |
| Avondale                     | 0.20  | ...  | 0.83                          | 1.64                                       |
| Botanical Experiment Station | 0.18  | 0.32 | 0.56                          | 1.70                                       |
| Bromley                      | ...   | 0.49 | 0.84                          | 1.75                                       |
| Cleveland Dam                | ...   | ...  | 0.07                          | 1.57                                       |
| Gwebi                        | ...   | ...  | 0.11                          | 1.65                                       |
| Hillside                     | 0.04  | 0.38 | 0.68                          | 1.61                                       |
| Lilfordia                    | ...   | ...  | ...                           | 1.54                                       |
| Lochinvar                    | ...   | ...  | ...                           | n.s.                                       |
| Manor Farm                   | ...   | 0.40 | 0.40                          | n.s.                                       |
| Salisbury Gaol               | ...   | 0.20 | 0.36                          | 1.63                                       |
| Sebastopol                   | ...   | ...  | 0.23                          | 1.66                                       |
| Selby                        | 0.40  | 0.68 | 1.08                          | 1.44                                       |
| Stapleford                   | ...   | ...  | 0.15                          | 1.73                                       |
| Tisbury                      | ...   | 0.16 | 0.24                          | n.s.                                       |
| Vainona                      | 0.11  | 0.31 | 0.73                          | 1.74                                       |

## RAINFALL—(Continued).

| STATION.              | 1923. |      | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|-----------------------|-------|------|-------------------------------|--------------------------------------------|
|                       | Sept. | Oct. |                               |                                            |
| ZONE C (Continued)    |       |      |                               |                                            |
| Sebungwe—             |       |      |                               |                                            |
| Sikombela ...         | —     | —    | ...                           | 1.40                                       |
| Wolverley ...         | ...   | ...  | ...                           | n.s.                                       |
| ZONE D. :             |       |      |                               |                                            |
| Darwin—               |       |      |                               |                                            |
| La Belle Esperance... | —     | —    | ...                           | n.s.                                       |
| Mount Darwin ...      | ...   | ...  | ...                           | 1.60                                       |
| Inyanga—              |       |      |                               |                                            |
| Carlow ...            | ...   | ...  | ...                           | n.s.                                       |
| Inyanga ...           | 0.23  | 0.89 | 2.67                          | 1.90                                       |
| Juliasdale ...        | 0.19  | 0.58 | 2.91                          | n.s.                                       |
| Rhodes Estate ...     | —     | 1.27 | 3.14                          | 1.86                                       |
| York ...              | ...   | ...  | 0.21                          | ...                                        |
| Makoni—               |       |      |                               |                                            |
| Eagle's Nest ...      | —     | ...  | 1.43                          | 1.69                                       |
| Forest Hill ...       | 0.07  | 0.12 | 0.61                          | 1.81                                       |
| Riversdale...         | —     | 1.11 | 1.56                          | n.s.                                       |
| Wensleydale ...       | 0.05  | 0.84 | 2.28                          | 1.70                                       |
| Mazoe—                |       |      |                               |                                            |
| Atherstone ...        | ...   | ...  | ...                           | n.s.                                       |
| Avonduur ...          | ...   | ...  | ...                           | ...                                        |
| Benridge ...          | —     | ...  | ...                           | 1.86                                       |
| Bindura ...           | —     | 0.05 | 0.25                          | 1.81                                       |
| Ceres ...             | 0.23  | 0.33 | 1.01                          | 1.98                                       |
| Chipoli ...           | ...   | 0.36 | 0.36                          | 1.67                                       |
| Citrus Estate ...     | —     | 0.59 | 0.69                          | 1.66                                       |
| Craigengower ...      | —     | 0.77 | 0.81                          | 1.83                                       |
| Glen Divis ...        | ...   | 0.22 | 0.32                          | n.s.                                       |
| Great B ...           | ...   | ...  | ...                           | n.s.                                       |
| Kilmer ...            | —     | 0.10 | 0.10                          | 1.84                                       |
| Kingston ...          | 0.15  | 0.15 | 0.79                          | 1.92                                       |
| Mazoe ...             | 0.29  | 0.57 | 0.89                          | 1.68                                       |
| Marienzi ...          | —     | —    | 0.82                          | n.s.                                       |
| Marston...            | ...   | ...  | ...                           | n.s.                                       |
| Mgutu ...             | —     | 0.92 | 0.97                          | 1.42                                       |
| Omeath ...            | —     | 0.53 | 0.69                          | 1.65                                       |
| Pearson Settlement    | —     | 0.56 | 0.56                          | n.s.                                       |
| Ruia ...              | —     | 1.37 | 1.60                          | 1.89                                       |
| Ruoko Ranch ...       | —     | 0.53 | 0.76                          | 1.72                                       |
| Shamva ...            | —     | ...  | ...                           | 1.78                                       |
| Stanley Kop ...       | —     | 0.72 | 0.77                          | 1.59                                       |
| Sunnyside ...         | —     | 0.60 | 0.66                          | 1.73                                       |
| Teign ...             | 0.07  | ...  | 0.07                          | n.s.                                       |
| Usk ...               | ...   | 1.51 | 1.51                          | n.s.                                       |
| Virginia ...          | —     | 0.56 | 0.56                          | 1.61                                       |
| Visa ...              | ...   | ...  | ...                           | n.s.                                       |
| Woodlands ...         | 0.25  | 0.20 | 1.31                          | n.s.                                       |
| Zombi ...             | —     | 0.49 | 1.63                          | 1.70                                       |

## RAINFALL—(Continued).

| STATION.                   | 1923. |      | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|----------------------------|-------|------|-------------------------------|--------------------------------------------|
|                            | Sept. | Oct. |                               |                                            |
| ZONE D.—(Continued)        |       |      |                               |                                            |
| Mrewa—                     |       |      |                               |                                            |
| Glen Somerset ...          | ...   | ...  | 0.31                          | 1.83                                       |
| Mrewa ...                  | —     | 1.34 | 2.74                          | 1.80                                       |
| Selous Nek ...             | —     | 0.53 | 0.89                          | 1.78                                       |
| Mtoko—                     |       |      |                               |                                            |
| Makaha ...                 | —     | —    | 0.22                          | 1.93                                       |
| Mtoko ...                  | ..    | 0.57 | 0.88                          | 1.48                                       |
| Salisbury—                 |       |      |                               |                                            |
| Arcturus ...               | ...   | 1.13 | 1.46                          | n.s.                                       |
| Chindamora Reserve ...     | ...   | 0.84 | 1.01                          | n.s.                                       |
| Glenara ...                | ...   | ...  | ...                           | 1.61                                       |
| Goromonzi ...              | —     | 2.59 | 2.82                          | 1.98                                       |
| Hatcliffe (Borrowdale) ... | —     | —    | 0.19                          | 2.70                                       |
| Hillside (Bromley) ...     | —     | 0.48 | 1.07                          | n.s.                                       |
| Kilmuir ...                | 0.43  | 1.18 | 2.16                          | n.s.                                       |
| Meadows ...                | —     | 0.52 | 0.69                          | 2.04                                       |
| Springs ...                | ...   | 0.57 | 0.79                          | n.s.                                       |
| Vieta ...                  | ...   | 0.18 | 0.18                          | n.s.                                       |
| ZONE E. :                  |       |      |                               |                                            |
| Belingwe—                  |       |      |                               |                                            |
| Belingwe (N.C.) ...        | —     | —    | ...                           | n.s.                                       |
| The Doro ...               | ...   | ...  | 0.15                          | n.s.                                       |
| Shabani... ..              | —     | —    | ...                           | n.s.                                       |
| Bikita—                    |       |      |                               |                                            |
| Angus Ranch ...            | 0.03  | 0.04 | 0.21                          | n.s.                                       |
| Bikita ...                 | 0.36  | 0.02 | 0.77                          | 3.44                                       |
| Devuli Ranch ...           | ...   | ...  | ...                           | n.s.                                       |
| Charter—                   |       |      |                               |                                            |
| Buhera ...                 | ...   | ...  | 1.25                          | 1.53                                       |
| Riversdale ...             | ...   | ...  | ...                           | 1.60                                       |
| Chibi—                     |       |      |                               |                                            |
| Chibi ...                  | ...   | ...  | ...                           | 1.40                                       |
| Chilimanzi—                |       |      |                               |                                            |
| Chilimanzi ...             | ...   | ...  | 0.25                          | 1.51                                       |
| Driefontein ...            | 0.07  | 0.07 | 0.22                          | 1.39                                       |
| Felixburg ...              | ...   | ...  | ...                           | n.s.                                       |
| Grootfontein ...           | ...   | ...  | ...                           | 1.41                                       |
| Induna Farm ...            | —     | 0.07 | 0.24                          | 1.49                                       |
| Requeza Estate ...         | ...   | 0.10 | 0.12                          | n.s.                                       |
| Gutu—                      |       |      |                               |                                            |
| Gutu ...                   | ...   | ...  | ...                           | 1.54                                       |
| Glenary ...                | —     | —    | 0.79                          | n.s.                                       |
| M'vimvi Ranch ...          | ...   | ...  | ...                           | 1.47                                       |
| Tel-el-Kebir ...           | —     | ...  | 0.28                          | 1.51                                       |
| Gwelo—                     |       |      |                               |                                            |
| Lover's Walk ...           | ...   | ...  | ...                           | 0.94                                       |
| Oaklands ...               | —     | ...  | 0.05                          | 1.14                                       |
| Partridge Farm ...         | —     | 1.81 | 1.83                          | 1.15                                       |
| Sheep Run Farm ...         | ...   | 0.78 | 0.78                          | 1.05                                       |

## RAINFALL—(Continued).

| STATION.                       | 1923. |      | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|--------------------------------|-------|------|-------------------------------|--------------------------------------------|
|                                | Sept. | Oct. |                               |                                            |
| Zone E.—(Continued)            |       |      |                               |                                            |
| Insiza—                        |       |      |                               |                                            |
| Roodeheuevel ... ..            | ...   | ...  | ...                           | 1.61                                       |
| Inyanga—                       |       |      |                               |                                            |
| St. Trias' Hill ... ..         | 0.13  | —    | 0.75                          | 2.05                                       |
| Makoni—                        |       |      |                               |                                            |
| Chitora... ..                  | 0.03  | 0.72 | 1.19                          | 1.80                                       |
| Craigendoran ... ..            | —     | 0.08 | 0.93                          | 1.58                                       |
| Gorubi Springs ... ..          | 0.05  | 0.15 | 0.44                          | 1.94                                       |
| Mona ... ..                    | 0.10  | 1.56 | 2.20                          | 1.78                                       |
| Monte Cassino ... ..           | —     | 0.60 | 1.24                          | 1.30                                       |
| Rusape ... ..                  | —     | 0.62 | ...                           | 1.50                                       |
| Springs ... ..                 | ...   | ...  | ...                           | 1.90                                       |
| Marandellas—                   |       |      |                               |                                            |
| Bonongwe ... ..                | ...   | ...  | ...                           | n.s.                                       |
| Delta ... ..                   | ...   | 0.03 | 0.03                          | 1.86                                       |
| Igudu ... ..                   | —     | —    | 0.10                          | n.s.                                       |
| Land Settlement ... ..         | —     | 0.16 | 0.51                          | 1.68                                       |
| Lendy Estates ... ..           | ...   | ...  | ...                           | 1.85                                       |
| Marandellas ... ..             | ...   | 0.61 | 0.61                          | 1.88                                       |
| Nelson ... ..                  | ...   | ...  | 0.05                          | 1.56                                       |
| Tweedjan ... ..                | —     | 0.55 | 0.55                          | 2.05                                       |
| White Gambolo Ranch ... ..     | 0.02  | 0.25 | 0.58                          | n.s.                                       |
| Melsetter—                     |       |      |                               |                                            |
| Brackenbury ... ..             | 0.51  | —    | 2.32                          | 2.66                                       |
| Tom's Hope ... ..              | 0.56  | 0.22 | 1.81                          | 2.40                                       |
| Ndanga—                        |       |      |                               |                                            |
| Doornfontein ... ..            | 0.17  | 0.02 | 0.47                          | 1.45                                       |
| Maruh Ranch ... ..             | ...   | ...  | ...                           | 1.71                                       |
| Ndanga... ..                   | ...   | ...  | ...                           | 2.21                                       |
| Selukwe—                       |       |      |                               |                                            |
| Aberfoyle Ranch ... ..         | —     | —    | ...                           | 1.78                                       |
| Hillingdon ... ..              | —     | 0.49 | 0.58                          | 1.61                                       |
| Impali Source ... ..           | 0.17  | 0.06 | 0.25                          | n.s.                                       |
| Rio ... ..                     | —     | —    | ...                           | 1.49                                       |
| Selukwe Gaol ... ..            | ...   | ...  | ...                           | n.s.                                       |
| Umtali—                        |       |      |                               |                                            |
| Argyll ... ..                  | 0.09  | 0.13 | 1.76                          | 1.86                                       |
| Gilmerton ... ..               | —     | —    | 0.61                          | 1.60                                       |
| Jerain ... ..                  | 0.16  | ...  | 0.33                          | 1.66                                       |
| Mutambara Mission ... ..       | ...   | ...  | ...                           | 1.50                                       |
| Odzani Power Station ... ..    | 0.10  | 0.01 | 1.04                          | 1.84                                       |
| Park Farm ... ..               | 0.30  | 0.26 | 1.66                          | n.s.                                       |
| Premier Estate ... ..          | 0.29  | ...  | 1.76                          | 1.52                                       |
| Sarum ... ..                   | —     | 0.36 | 1.62                          | 1.86                                       |
| Stapleford ... ..              | 1.23  | 1.69 | 4.34                          | 3.26                                       |
| St. Augustine's Mission ... .. | ...   | 0.59 | 2.02                          | n.s.                                       |
| Umtali (Gaol) ... ..           | 0.26  | 0.09 | 1.20                          | 1.63                                       |
| Victoria—                      |       |      |                               |                                            |
| Brucehame ... ..               | —     | ...  | 0.06                          | 1.49                                       |
| Cambria ... ..                 | ...   | ...  | 0.10                          | n.s.                                       |
| Chevenden ... ..               | 0.32  | —    | 0.62                          | n.s.                                       |



## RAINFALL—(Continued).

| STATION.                   | 1923. |      | Total<br>to end of<br>period. | Normal<br>rainfall<br>to end of<br>period. |
|----------------------------|-------|------|-------------------------------|--------------------------------------------|
|                            | Sept. | Oct. |                               |                                            |
| ZONE E.—(Continued)        |       |      |                               |                                            |
| Victoria (Continued)—      |       |      |                               |                                            |
| Clipsam ... ..             | ...   | —    | ...                           | 1.49                                       |
| Glenlivet ... ..           | 0.29  | 0.04 | 0.74                          | n.s.                                       |
| Gokomere ... ..            | 0.24  | 0.03 | 0.36                          | 1.34                                       |
| Histonhurst ... ..         | 0.17  | —    | 0.17                          | 1.40                                       |
| Makahori Farm ... ..       | ...   | ...  | ...                           | n.s.                                       |
| Makorsi River Ranch ... .. | 0.09  | 0.02 | 0.22                          | 1.72                                       |
| Mashaba ... ..             | 0.08  | ...  | 0.08                          | n.s.                                       |
| Morgenster Mission ... ..  | 0.30  | —    | 0.77                          | 2.09                                       |
| M'Sali ... ..              | ...   | ...  | ...                           | n.s.                                       |
| Riverdene North ... ..     | 0.10  | 0.04 | 0.23                          | 1.35                                       |
| Salemore ... ..            | ...   | ...  | 0.22                          | n.s.                                       |
| Silver Oaks ... ..         | 0.06  | 0.01 | 0.28                          | 1.47                                       |
| Stanmore ... ..            | —     | ...  | 0.19                          | 1.45                                       |
| Summerton ... ..           | —     | 0.01 | 0.01                          | 1.30                                       |
| Tewkesbury ... ..          | —     | ...  | ...                           | n.s.                                       |
| Tichidza ... ..            | 0.23  | 0.60 | 1.28                          | 1.81                                       |
| Victoria ... ..            | 0.10  | 0.08 | 0.29                          | 1.35                                       |
| Zimbabwe ... ..            | ...   | ...  | 0.13                          | n.s.                                       |
| ZONE F.:                   |       |      |                               |                                            |
| Melsetter—                 |       |      |                               |                                            |
| Chikore ... ..             | 0.39  | ...  | 0.50                          | 2.43                                       |
| Chipinga ... ..            | 0.47  | ...  | 0.91                          | 2.47                                       |
| Melsetter ... ..           | 0.19  | 0.19 | 0.70                          | 2.90                                       |
| Mount Selinda ... ..       | 0.97  | ...  | 1.28                          | 3.51                                       |
| Vermont ... ..             | 2.02  | ...  | 3.00                          | 3.38                                       |
| Umtali—                    |       |      |                               |                                            |
| Hoboken ... ..             | 0.53  | 0.71 | 1.24                          | 3.02                                       |

— means nil.

... means no return.

**Dates of Meetings of Farmers' Associations, Southern Rhodesia—(SUBJECT TO ALTERATION)**

[illegible]

\* December meeting only to be held at Umvukwe Ranch.

## Departmental Bulletins.

The following Bulletins, consisting of reprints of articles which have appeared in this Journal, are available for distribution free of charge to applicants in Southern Rhodesia only:—

### AGRICULTURE AND CROPS.

- No. 174. Notes on Hop Growing, by H. G. Mundy, F.L.S.
- No. 193. Oats in Southern Rhodesia, by H. Godfrey Mundy, F.L.S.
- No. 194. Rye, by J. A. T. Walters, B.A.
- No. 201. Dhal or Pigeon-Pea, by J. A. T. Walters, B.A.
- No. 218. Useful Measurements for Maize, by J. A. T. Walters, B.A.
- No. 225. Napier Fodder or Elephant Grass, by J. A. T. Walters, B.A.
- No. 232. Witch Weed or Rooi-Bloem, by J. A. T. Walters, B.A.
- No. 244. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 256. Prospects of Maize and Tobacco Crops, 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.
- No. 262. Root Crops, Cultural Notes on, by J. A. T. Walters, B.A.
- No. 269. Farming in Granite Country, by R. C. Simmons.
- No. 278. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 305. Manure Supplies, by E. V. Flack.
- No. 306. New Crops for Rhodesia, by J. A. T. Walters, B.A.
- No. 309. Maize Grading, by E. A. Nobbs, Ph.D., B.Sc.
- No. 327. Linseed, by C. Mainwaring
- No. 351. Improvement of Rhodesian Pastures, by H. G. Mundy, F.L.S.
- No. 362. The Cultivation of Rice, by H. G. Mundy, F.L.S.
- No. 372. Wheat in Rhodesia, by H. G. Mundy, F.L.S.
- No. 374. Fibre Crops, by J. A. T. Walters, B.A.
- No. 375. Selection of Virgin Land for Arable Farming, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 388. Kudzu Vine, by H. G. Mundy, F.L.S.
- No. 389. Maize for Export, by C. Mainwaring.
- No. 394. The Interdependence of Crop Rotation and Mixed Farming, by H. G. Mundy, F.L.S.
- No. 397. The Advantage of Autumn and Early Winter Ploughing, by C. Mainwaring.
- No. 399. Green Manuring and Soil Management, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.
- No. 403. Florida Beggar Weed, by H. G. Mundy, F.L.S.
- No. 407. Wheat—Extracts from Bulletin No. 22, Victoria, Australia.
- No. 408. The Velvet Bean, by J. A. T. Walters, B.A.
- No. 416. Grasses of Agricultural Importance in Southern Rhodesia, by H. G. Mundy, F.L.S., G. N. Blackshaw, O.B.E., B.Sc., F.I.C., and E. V. Flack.

- No. 417. The Ground Nut or Monkey Nut, by C. Mainwaring.  
No. 422. Improvement of Rhodesian White Maize by Selection, by C. Mainwaring.  
No. 423. The Common Sunflower, by C. Mainwaring.  
No. 428. The Sweet Potato, by J. A. T. Walters, B.A.  
No. 429. Propagation of Kudzu Vine, by H. C. Arnold.  
No. 442. Swamp or Irrigation Rice, by K. V. Yoshi, Bombay.  
No. 445. Production of Maize, by C. Mainwaring.  
No. 454. The Growing of Potatoes in Southern Rhodesia, by C. Mainwaring.  
No. 455. White v. Yellow Maize, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.  
No. 456. Legumes in Southern Rhodesia, by J. A. T. Walters.  
No. 462. Hay-making in Rhodesia, by C. Mainwaring.  
No. 464. Ensilage, by J. A. T. Walters, B.A.  
No. 466. Cotton Culture, by H. W. Taylor, B.Agr.  
No. 473. A Calendar of Farm Crop Sowings, by C. Mainwaring.  
Botanical Specimens for Identification.

## REPORTS ON CROP EXPERIMENTS.

- No. 94. Second Report on Experiments, by J. H. Hampton.  
No. 189. The Manuring of Maize on the Government Experiment Farm. Gwebi, by G. N. Blackshaw, B.Sc., F.C.S.  
No. 216. Manuring of Maize on Government Experiment Farm, Gwebi, by A. G. Holborow, F.I.C.  
No. 220. Reports on Crop Experiments, Gwebi, 1914-15, by E. A. Nobbs, Ph.D., B.Sc.  
No. 221. Results of Experiments, Longila, 1914-15, by J. Muirhead.  
No. 239. Reports on Crop Experiments, Gwebi, 1915-16, by E. A. Nobbs, Ph.D., B.Sc.  
No. 240. Manuring of Maize and Fertiliser Experiments at Gwebi, by A. G. Holborow, F.I.C.  
No. 246. Reports on Crop Experiments, Gwebi, 1915-16, Part II., by E. A. Nobbs, Ph.D., B.Sc.  
No. 268. Manuring Maize, Government Farm, Gwebi, by A. G. Holborow, F.I.C.  
No. 279. Report on Crop Experiments, Gwebi, 1916-17, by E. A. Nobbs, Ph.D., B.Sc.  
No. 304. Report on Experiments, Gwebi, 1917-18, by E. A. Nobbs, Ph.D., B.Sc.  
No. 341. Report on Crop Experiments, 1918-19, Gwebi Experiment Farm.  
No. 342. Rotation Experiments, 1913-1919, by H. G. Mundy, F.E.S., and J. A. T. Walters, B.A.  
No. 363. The Manuring of Maize at Makwiro, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.  
No. 382. Annual Report of Experiments, Experiment Station, Salisbury, 1919-1920.  
No. 405. Annual Report of Crop Experiments, 1920-21, Gwebi Experiment Farm, by H. G. Mundy, F.L.S., and J. H. Hampton.  
No. 411. Annual Report of Experiments, 1920-21, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.  
No. 413. Arlington Sand Veld Experiment Station, First Report, by H. G. Mundy, F.L.S., and E. E. Wright.  
No. 432. Bulawayo Municipal Experiment Station, First Report, by H. G. Mundy, F.L.S.  
No. 433. Winter Cereal Experiments, 1921, by D. E. McLoughlin.

- No. 437. Annual Report on Crop Experiments, Gwebi, 1921-22, by H. G. Mundy, F.L.S.  
 No. 440. Annual Report of Experiments, 1921-22, Experiment Station, Salisbury, by H. G. Mundy, F.L.S.  
 No. 467. Soil Treatment and Manuring for Maize Production, by G. N. Blackshaw, O.B.E., B.Sc., F.I.C.

## TOBACCO.

- No. 373. Turkish Tobacco, by H. W. Taylor, B.Agr.  
 No. 398. Wildfire and Angular Spot.  
 No. 404. Flue-Curing Tobacco Barns and Packing House (Second Revision), by A. C. Jennings, A.M.I.C.E., A.M.I.E.E.  
 No. 410. Common Mistakes in Growing and Handling Virginia Tobacco, by H. W. Taylor, B.Agr.  
 No. 444. Tobacco Seed Beds, by H. W. Taylor, B.Agr.  
 No. 461. The Growing of Virginia Tobacco in Southern Rhodesia—Field Operations, by H. W. Taylor, B.Agr.  
 Handbook of Tobacco Culture for Planters in Southern Rhodesia, price 2s. 6d., post free outside South Africa 3s. 6d.

## STATISTICS.

- No. 196. Collection of Agricultural Statistics in Southern Rhodesia, by Eric A. Nobbs, Ph.D., B.Sc.  
 No. 209. The Agricultural Returns for 1914, by B. Haslewood, F.S.S.  
 No. 224. Statistical Returns of Crops in Southern Rhodesia for the Season 1914-15, by E. A. Nobbs, Ph.D., B.Sc., and B. Haslewood.  
 No. 230. Farm and Live Stock Statistics, 1915, by Eric A. Nobbs, Ph.D., B.Sc., and B. Haslewood, F.S.S.  
 No. 247. Statistical Returns of Crops grown by Europeans in Southern Rhodesia for the Season 1915-16, by Eric A. Nobbs, Ph.D., B.Sc., Director of Agriculture, and Fred. Eyles, F.L.S., Statistician.  
 No. 259. Statistics of Live Stock and Animal Produce, 1916, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.  
 No. 281. Statistics of Crops, 1916-17, by F. Eyles, F.L.S.  
 No. 286. Statistics of Live Stock and Animal Produce for the Year 1917, by Eric A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.  
 No. 303. Statistics of Crops, 1917-18, by E. A. Nobbs, Ph.D., B.Sc., and F. Eyles, F.L.S.  
 No. 322. Statistics of Live Stock and Animal Produce, 1918, by F. Eyles, F.L.S.  
 No. 361. Statistics of Live Stock and Animal Produce for the Year 1919, by F. Eyles, F.L.S.  
 No. 380. Statistics of Crops grown by Europeans in Southern Rhodesia, 1919-1920, by H. C. K. Fynn.  
 No. 393. Statistics of Live Stock and Animal Produce for 1920, by H. C. K. Fynn.  
 No. 409. Statistics of Crops Grown by Europeans in Southern Rhodesia for the season 1920-21, by H. C. K. Fynn.  
 No. 426. Statistics of Live Stock and Animal Products for the year 1921, by H. C. K. Fynn.  
 No. 443. Statistics of Crops Grown by Europeans in Southern Rhodesia for the Season 1921-22, by F. Eyles, F.L.S., and H. C. K. Fynn.  
 No. 459. Statistics of Live Stock and Animal Products for the Year 1922, by A. Borradaile Bell.

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## Government Notices.

Government Notices affecting the farming industry will in future be published only *once* in the *Agricultural Journal*. This applies to original Notices and to amending Notices. Readers are, therefore, advised to preserve their files of back numbers of the *Journal*, to which they will be able to refer for information respecting the various laws, regulations, etc., in force.

No. 72 of 1923.]

[16th November, 1923.]

HIS Excellency the Governor-in-Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 401 of 1923, and, in terms of section 17 of Government Notice No. 21 of 1917, to declare the following areas of infection and guard area in lieu thereof:—

### CHARTER AND CHILIMANZI NATIVE DISTRICTS.

#### (a) *Areas of Infection.*

1. The Wiltshire and Worcestershire Estates.
2. The farms Norah Lee, Homanhurst, Altona and the Mangeni Reserve.
3. The farms Swartfontein, Rooipoort, Rockydale and Ferreiraton Commonage.
4. The farms Onze Rust, Elminie and Inhoek.
5. The farms Jackalsdraai and Kopje Alleen.
6. The farms Stockdale, Spurwing and the Narira Reserve.
7. The sub-division of Nyamazaan known as Hoffmania.
8. The farm Totton.
9. The farm Swindon.
10. The farm Chipisa.
11. The farm Mooifontein.
12. An area within a radius of four miles of Mswana's Kraal in the Sabi Reserve.
13. An area within a radius of four miles of Bindura's Kraal in the Sabi Reserve.
14. Farms Knockholt, Kuruman and Hanerau.

### HARTLEY, MARANDELLAS, CHARTER, CHILIMANZI AND GUTU NATIVE DISTRICTS.

#### (b) *Guard Area.*

An area bounded by and including the farms Mserenge, Glynn, Bucknall, Sunnyside, Vergenoeg, Alpha, Pot Luck; thence down the Sabi River to its junction with the Rumwengi River; thence up the latter to its headwaters; thence in a south-westerly direction to the headwaters of the Nyamhonga River, and down this river to its junction with the Nyadzidza River, and up the latter, the Inyazitza and Nyamatsetse Rivers to the farm Riversdale; thence by and including the farms Riversdale, Markdale, Hilton, Landskroon, Delport's Wish, Hugosfontein, Swartfontein C, Singlethorn, that portion of Antelope lying north of the Umvuma-Enkeldoorn Road, Uitzicht, Paddocks Nos. 39, 40, 41, 45, 46, 48 and 49, Central Estates, Rhodesdale, that portion of the Charter Native District lying north of the Ngesi River, the farms Wheelerdale, Adlam's Rest, Brakveld, Gorali, Orangia, Emondo, Georgina, Maas Plein, Xekene and Balcome; thence along the Charter Road to the farm first named.

19th November, 1923.

FERTLISERS.

[illegible]

**FARM FOODS.**

No. 73 of 1923.]

[16th November, 1923.]

HIS Excellency the Governor-in-Council has been pleased, under the provisions of the "Animals Diseases Consolidation Ordinance, 1904," to cancel Government Notice No. 456 of 1923, and, in terms of section 17 of Government Notice No. 21 of 1917, to declare the following areas of infection and guard areas in lieu thereof:—

## NATIVE DISTRICT OF MELSETTER.

(a) *Areas of Infection.*

1. The farms Merino, Smalldeed, Sable Home, Hermit, Umzelezwe, Bamboo Creek, Elandsberg and Umsasa.
2. Morgenson, Enhoek and Canterbury.

(b) *Guard Areas.*

1. That portion of the native district of Melsetter lying south of and including the farms Emerald, Elandsberg, Flenters, Nyatutu, Chikore Annex, Chikore and Musikiwanu Reserve.
2. An area bounded by and including the farms Clearwater, Newcastle, Landsdowne, Heilrand, Woodstock, Ravenswood, Wolfscrag, Avontuur and Nootgedacht.

No. 39 of 1923.]

[26th October, 1923.]

IT is hereby notified that His Excellency the Governor has been pleased, under the provisions of section 4, sub-section (3), of the "Game Law Consolidation Ordinance, 1906," to approve of the retention of koodoo in class "B" of game as defined in the said Ordinance until 30th November, 1925.

No. 50 of 1923.]

[2nd November, 1923.]

## ESTABLISHMENT OF PUBLIC ROADS NEAR SHANGANI.

IT is hereby notified that His Excellency the Governor-in-Council has been pleased, under the provisions of section 2 of "The Road Regulations, 1896," to declare the following roads to be a district road and branch roads respectively, i.e.:—

(a) Fort Rixon-Shangani district road, from the Fort Rixon public offices, running thence north-easterly through the farms Hlolo, Ndumanumbi and Ruins, the western corner of Shangani Heights, Albany, the eastern corner of Tsunda, the southern end of Thornville and the northern portion of Dandasi, joining the Shangani-Belingwe district road in Dandasi.

(b) Shangani Heights-Albany branch road, from the homestead on Shangani Heights, running thence south-westerly over this farm and thence northerly through Albany and to the west of the homestead thereon, joining the Fort Rixon-Shangani district road at the hill near the said homestead.

(c) Shangani Heights-Orangedale branch road, from a point on the Fort Rixon-Shangani district road where it crosses the western corner of Shangani Heights, running thence easterly through this farm and over Orangedale till it joins the Shangani-Belingwe district road thereon.

No. 51 of 1923.]

[2nd November, 1923.]

CLOSURE OF ROAD ON DEVONDALE FARM,  
BULALIMA-MANGWE DISTRICT.

IT is hereby notified that His Excellency the Governor-in-Council has been pleased, under the provisions of section 1 of "The Road Alteration Ordinance, 1903," to declare that the following road shall cease to be a road for public use from date hereof, i.e., that portion of the old Figtree-Seluci Mission road running north-westerly from the Figtree Hotel, on the west of the Figtree Railway Station, which lies over the farm Devondale, in the Bulalima-Mangwe district.

No. 62 of 1923.]

[9th November, 1923.]

### ESTABLISHMENT OF BRANCH ROAD NEAR WHITECLIFFE SIDING, MAZOE DISTRICT.

IT is hereby notified that His Excellency the Governor-in-Council has been pleased, under the provisions of section 2 of "The Road Regulations, 1896," to declare the following road to be a branch road, *i.e.*, a road, not exceeding sixty feet in width, leading from the branch road, declared under Government Notice No. 312 of 1921, at the northern boundary of farm Granite, running thence south-easterly over Granite for the length of the southern boundary of farm No. 16, Glendale, and thence on the boundary line common to farm No. 13, Glendale, and Granite, through Laurencedale to the west of the homestead thereon and through Georgia, joining the Mazoe-Glendale road on the latter farm.

No. 63 of 1923.]

[9th November, 1923.]

### ESTABLISHMENT OF BRANCH ROAD FROM UMTALI COMMONAGE TO FERN VALLEY FARM.

IT is hereby notified that His Excellency the Governor-in-Council has been pleased, under the provisions of section 2 of "The Road Regulations, 1896," to declare the following route to be a branch road, *i.e.*, from a point on the Umtali Commonage where the present Melsetter road branches off from the old Melsetter road, along the old Melsetter road through Umtali Commonage into Quagga's Hoek, through Quagga's Hoek to a point about 400 yards from the common boundary of Quagga's Hoek and Fern Valley, and thence along the old Zimunya road, also known as Cripps' old road, to where it crosses the northern boundary of Fern Valley, near its north-eastern beacon.

### EXPORT OF COTTON TO THE UNION OF SOUTH AFRICA FROM SOUTHERN RHODESIA.

IT is hereby notified for public information that the Government of the Union of South Africa is prepared to allow the importation of cotton produced in Southern Rhodesia only under the following regulations and in terms of Union Proclamation No. 67 of 1921.

No cotton, the produce of Southern Rhodesia, may be imported into the Union of South Africa unless accompanied by a permit, which may be obtained from the Director of Agriculture, Salisbury, and issued by him on behalf of the Government of the Union of South Africa.

Applications for permits must be accompanied by the following information:—

Form—seed cotton (unginned cotton), cotton lint or cotton seed.

Source—farm on which produced.

Quantity—net weight of consignment.

Purpose intended for—

- (1) consignment to a Union port for export;
- (2) manufacture or use in Union;
- (3) transmission through Union to Portuguese East Africa;
- (4) ginning at a ginning establishment; or
- (5) crushing at a seed crushing establishment.

Cotton seed intended for sowing will only be admitted into the Union on special permission, application for which should in the first instance be addressed to the Director of Agriculture, Salisbury.

ERIC A. NOBBS,  
Director of Agriculture.

No. 55.]

[2nd November, 1923.

*Applications for Use of Water in terms of the "Water Ordinance, 1913," as amended from time to time.*

IT is hereby notified that the following applications have been made for authority to use water:—

| Name of applicant.                                                       | Farm.                     | Native district of | From what river.    | Nature of application.                     | Purpose for which required. | Period for objection.             |
|--------------------------------------------------------------------------|---------------------------|--------------------|---------------------|--------------------------------------------|-----------------------------|-----------------------------------|
| E. F. B. Head (by consent of His Excellency the Governor of S. Rhodesia) | Skiddaw                   | Lomagundi          | Gassitani           | To divert public water                     | To irrigate 15 acres        | Three months from 2nd Nov., 1923  |
| J. S. Maritz (by consent of His Excellency the Governor of S. Rhodesia)  | Fangudu                   | Untali             | Yakabewa            | do.                                        | To irrigate 30 acres        | do.                               |
| A. T. Holland                                                            | Thornhill                 | Chilimanzi         | Masengi             | do.                                        | do.                         | do.                               |
| ...                                                                      | do.                       | do.                | Makoholi            | do.                                        | To irrigate 20 acres        | do.                               |
| Mrs. P. M. Wing                                                          | Rustington                | Mazoe              | Clearwater          | do.                                        | To irrigate 10 acres        | Three months from 26th Oct., 1923 |
| P. G. Kleynhans                                                          | No. 7, Watershed Block    | Gwelo              | Headwaters of Lundi | To divert public and storm water           | To irrigate 65 acres        | do.                               |
| The Riversdale Estates Synd., Ltd.                                       | Lots 6, 7 & 8 of Glengrey | Mazoe              | Unrodzi             | To divert public water                     | To irrigate 350 acres       | do.                               |
| P. A. Linder                                                             | Inyamazitzu               | Makoni             | Inyamazitzu         | To store and divert public and storm water | To irrigate 200 acres       | do.                               |

Any person or persons whose rights may be affected thereby are hereby called upon, in terms of the regulations published under Government Notice No. 539 of 1922, to lodge, within the period above specified from the date hereof, at the office of the Water Registrar, Salisbury, from whom further particulars are obtainable, their objections or other representations (if any) to the granting of these applications, together with a full statement of the grounds for such objections or representations.

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